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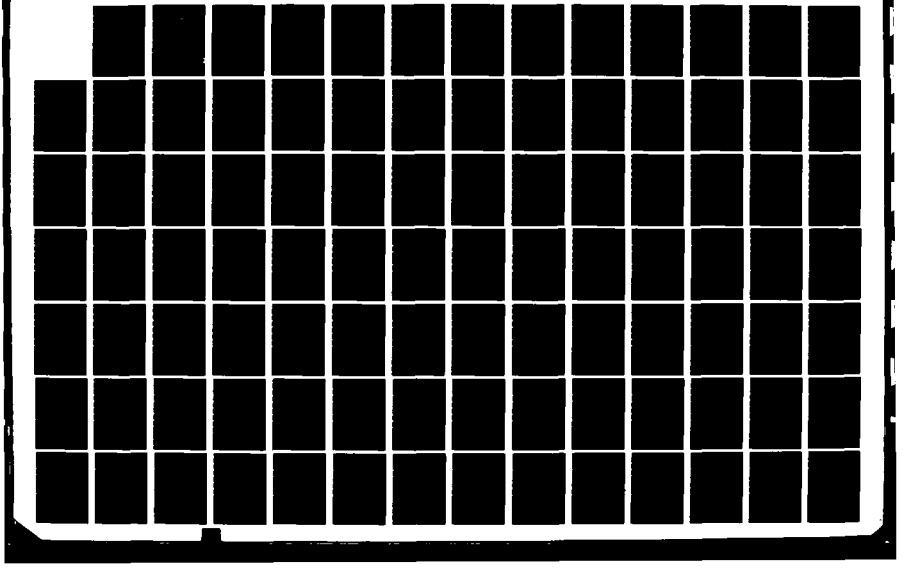

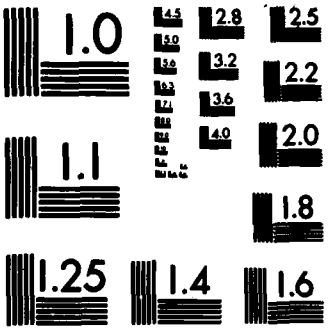

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A LIFE CYCLE COST MANAGEMENT PRIMER FOR USE WITHIN THE AERONAUTICAL SYSTEMS DIVISION

Captain Arnold K. Douville, USAF

LSSR 80-82

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (ATC)
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

A LIFE CYCLE COST MANAGEMENT PRIMER FOR USE WITHIN THE AERONAUTICAL SYSTEMS DIVISION

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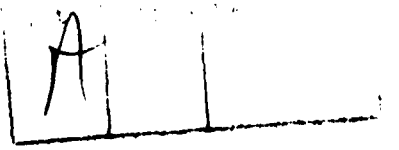

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A recent Air Force Audit Agency (AFAA) audit report on the LCC Management function at the Aeronautical Systems Division (ASD) cited a major deficiency in the implementation of LCC Management. In part, the problem is caused by the general lack of experience held by LCC focal points and managers within ASD program offices, as well as a lack of practical guidance and training. The audit team recommended that the ASD Life Cycle Cost Management Division (ASD/ACCL) develop a Life Cycle Cost Management Primer to provide practical LCC Management guidance to program office LCC focal points. The LCC Management Primer which serves as the basis for this thesis has been developed in response to the recommendation made by the audit team. It has been designed primarily to provide the novice LCC focal point a basis from which to establish a viable LCC Management program. That basis includes general guidance concerning the use of such accepted management tools as goals, trade-off analyses, and management control systems. It also includes a description of the documents used in managing a program and how those documents can precipitate program cost effectiveness through their LCC Management inputs. In addition to the benefits provided to the novice, the Primer should also be of some benefit to more experienced focal points. Specifically, the information provided in the Primer can serve as quick reference material for such key LCC Management elements as cost-related design goals. Sample inputs included in the Primer should provide the expert with new or additional ideas for developing particular LCC Management inputs.

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A LIFE CYCLE COST MANAGEMENT PRIMER FOR USE WITHIN THE AERONAUTICAL SYSTEMS DIVISION

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Systems Management

By

Arnold K. Douville, BS
Captain, USAF

March 1983

This thesis, written by

Captain Arnold K. Douville

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS MANAGEMENT

Date: 18 March 1983

Thomas C. Harrington

COMMITTEE CHAIRMAN

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CHAPTER I

INTRODUCTION

System Being Studied

Life Cycle Cost (LCC) Management is an acquisition management strategy used to ensure the procurement of defense systems which meet the operational needs of the Air Force at the lowest life cycle cost. The LCC management concept is not new. Its evolution began back in the early 1960s as the result of an increasing concern over the consequences of competitive procurement without regard to total system cost. It is currently implemented in acquisition programs through formal policy which requires that Air Force personnel consider the full impact of life cycle costs in decisions associated with the selection, design, development, procurement, modification, repair, or use of defense material (11).

The LCC Management concept is, in essence, a systems approach to management which advocates the use of goals and other management techniques to control the current and future cost consequences as well as the performance requirements and schedule constraints of a weapon system. As such, LCC Management requires that all program functional areas become involved in a total commitment to control and ultimately reduce total system costs. That commitment involves the

coordinated efforts of the program and functional area managers to:

1. Identify factors which have a significant impact on life cycle cost results and implement trade-off studies to evaluate alternative actions that could reduce the impact of such factors

2. Select product design goals which help to control life cycle cost results

3. Choose acquisition strategies that support life cycle cost objectives

4. Select sources for development, procurement, or production which offer the best balance between product performance and life cycle cost

5. Establish contract commitments, when appropriate, to help in controlling life cycle cost results

6. Conduct follow-on efforts subsequent to acquisition to improve system life cycle cost (11)

In summary, LCC management is a means for maintaining, through all program phases, a balanced perspective of all program requirements, constraints, and costs.

Problem Statement

A problem in implementing the LCC Management concept at the Aeronautical Systems Division (ASD) was revealed during a recent Air Force Audit Agency (AFAA) audit conducted between 22 September 1980, and 20 February 1981 (22). Specifically, the conclusions of Audit 975-10 indicate a

significant problem concerning the implementation of viable LCC Management programs within ASD System Program Offices (SPOs) (22). In part, the problem is caused by a general lack of LCC Management expertise in the SPOs. This lack of expertise is the result of a very transient LCC expertise base, due primarily to personnel rotation, and a lack of practical guidance and training for LCC focal points in the SPOs. Consequently, more and more of the responsibility for LCC Management falls on the shoulders of the ASD Comptroller's LCC Management Staff (ASD/ACCL). The end result is that the SPO LCC Management programs lose their effectiveness as internal control devices because LCC Management control is maintained by an ASD staff function which is far removed from the SPO internal decision making process.

Purpose

The purpose of this thesis is to provide ASD with a tool that will reduce the implementation problem cited in Audit 975-10. The tool is a Life Cycle Cost Management Primer which has been designed to:

1. Help close the gap between the expertise that exists at the Comptroller staff level and the lack of expertise that exists at the program office level

2. Provide practical information to both the novice and experienced LCC focal points and managers

3. Provide the basis for all LCC Management inputs

into program office internal control documents and external contracts

4. Provide justification for an effective LCC Management program within a program office

The Primer is attached as an appendix to this thesis in order to facilitate its dissemination and use within ASD.

Assumptions

It is assumed that the users of the LCC Management Primer are at least familiar with the policies and procedures involved in the procurement of defense systems. This familiarity need not encompass an in-depth knowledge of all regulations and directives pertaining to defense procurement. It is assumed, however, that the user does have a working knowledge of the documents used as sample inputs to the Primer, such as the Program Management Plan (PMP), Acquisition Plan, Source Selection Plan, and Request for Proposal (RFP).

Scope and Limitations

The Primer has been written primarily to assist novice LCC focal points and managers in developing timely LCC Management inputs to such documents as the PMP, the Acquisition Plan, the Source Selection Plan, and the Request for Proposal (RFP). The Primer should also provide useful information and reference material to more experienced LCC focal points and program managers. Although the Primer does

provide useful "boiler-plate" LCC Management inputs and general guidance, the user is cautioned that the sample inputs are not applicable to all programs without some modification.

Justification

In an article published in the January 1976 Defense Management Journal, O. C. Boileau stated:

> You don't have to be an economics expert to conclude . . . that DOD manpower and operation costs are chewing up the budget, such that in time there won't be money left for procurement [6:7].

Those remarks are even more pertinent today because of the increased scrutiny over and decreased buying power of our nation's defense budget. The DOD, aware of these problems, realizes that it can no longer rely on outdated methods for managing defense procurement which neglect the importance of system support. As a result, current DOD policy directives and regulations such as DOD Directives 5000.1 and 5000.2 are being designed to make significant and needed changes in our procurement strategy. The changes specifically require all programs to consider the consequences of future costs, and that a balance be achieved between system cost and effectiveness.

As with other changes in management structure, however, the change process can be slow. That fact was recently noted in an AFAA audit report of the LCC Management function at ASD. Among other problems concerning LCC Management, the audit team cited a major deficiency in

implementing LCC Management programs because of the general lack of experience held by LCC focal points and managers within the program offices. According to the audit team, the problem is compounded because there is little practical guidance provided to each focal point concerning LCC Management at the working level. As a result, the audit team recommended that the ASD Life Cycle Cost Management Division (ASD/ACCL) develop a Life Cycle Cost Management Primer to provide the practical guidance needed by program office LCC focal points. The LCC Management Primer included as Appendix A to this thesis is the fulfillment of that recommendation.

Methodology

The LCC Management Primer has been written primarily for LCC Management focal points located in System Program Offices (SPOs) at ASD. For that reason, it is essential that the Primer provide concise information concerning approved LCC Management practices which could be used to solve LCC Management problems that might occur on a day-to-day basis in the SPOs. Therefore, the Primer does not focus on LCC Management theory, rather it provides practical methods and examples to be used in solving LCC Management problems. With those thoughts in mind, it should be clear that a study limited to LCC documents or management textbooks was not sufficient for providing the information base needed for the Primer. In fact, the methodology used in

developing the Primer was actually based on the four major tasks described below.

First, LCC Management focal points from major SPOs such as the Airlift and Trainer, the Tactical Aircraft, the Strategic Systems, and the Engine System Program Offices were interviewed to obtain their opinions concerning the content of the Primer. It was felt that information from the interviews would lend credibility to the Primer because the focal points themselves provided significant and useful inputs to it. The interviews, which consisted of ten questions, were informal in nature. The questions used in the interviews were designed to prompt general discussion in specific areas, as opposed to being devices to elicit specific responses. The interview questionnaires were distributed to the interviewees one week prior to the interviews in order to generate forethought for planned responses. The questions included in the interviews and the interview responses are provided in Chapter III.

Along with the interviews described above, other informal fact-finding interviews were conducted with experts from such functional areas as contracting, logistics, engineering (reliability and maintainability) and cost analysis. These fact-finding interviews were used primarily to clarify issues and information obtained during the course of the literature review. Further, formal interviews with program managers concerning LCC Management were planned. However,

program considerations, scheduling constraints, and a level of interest on the part of the program managers led to their cancellation.

A literature review was the second major task accomplished for the development of the Primer. The literature review was used primarily to establish a factual basis for the Primer. That basis was derived through the numerous documents, regulations, articles, and books covered in the review. The topics included in the review ranged from a description of a goal setting process, to the systems management concept, to LCC program management guidance. A complete description and findings of the literature review is contained in Chapter II. Information from the interviews and the literature review was then used to write a draft LCC Management Primer.

The third task accomplished in the development of the Primer involved the dissemination of the Primer for expert comments. A copy of the draft Primer was provided to members of the ASD Life Cycle Cost Management Division for comments. This informal solicitation of comments was helpful in determining the legitimacy of the Primer. More importantly, the comments concerning the strengths and shortfalls of the Primer should help make the Primer helpful and understandable to ASD LCC focal points.

The fourth and final task in the development of the Primer is planned to occur approximately one year after its

publication. This final task will provide for the validation and further refinement of the Primer as a management tool. Specifically, a Post Use Validation Test is proposed to determine the Primer's strengths and weaknesses as a working tool. The validation test will involve the dissemination of a questionnaire by the ASD Life Cycle Cost Management Division (ACCL) to users of the Primer. Questionnaire responses should help determine the strength of the Primer and specific areas of weakness that can be corrected through subsequent modifications. While the administration of the questionnaire is beyond the scope of this thesis effort, the questionnaire has been developed and is included in Appendix B. It is hoped that the Post Use Validation Test will serve as a basis for further refinements to make the Primer a truly effective LCC Management tool.

Plan of the Report

This chapter presented an introduction to the thesis effort. The background, assumptions, scope and limitations, justification, and methodology were presented. It was noted that there exists a problem in the implementation of LCC Management programs because of the lack of experience of LCC focal points and managers, as well as a lack of practical guidance and training. In recognition of this problem, the purpose of this thesis is to provide a LCC Management Primer for ASD personnel. Chapter II presents the literature

review concerning the technical aspects of LCC Management. Chapter III provides the discussion of interview responses which were used with the information from the literature review to develop the Primer contained in Appendix A. The final chapter presents the research conclusions and recommendations.

CHAPTER II

LITERATURE REVIEW

This chapter presents the literature review accomplished on the subject of Life Cycle Cost (LCC) Management. The review is comprised of some thirty-five documents and incorporates the opinions, remarks, and ideas of both government and corporate LCC experts as well as personal testimony derived from my experiences as an ASD Life Cycle Cost Management consultant and analyst. Areas analyzed during the review and discussed in sections of this chapter include: the Life Cycle Cost Management Philosophy, Life Cycle Cost Management Implementation, and the Life Cycle Cost Management Status at ASD. Each major area is further broken down into subsections describing specific areas of concern. The review is structured to be consistent with the attached LCC Management Primer in order that a better understanding and appreciation of the information provided and conclusions drawn in the Primer can be achieved.

Life Cycle Cost Management Philosophy

This section reviews the current literature concerning the origins of the Life Cycle Cost (LCC) Management philosophy in order that the reader appreciates that LCC Management is not a new or mystical concept; rather, it is a

management philosophy based on sound and accepted management practices.

The Evolution of LCC Management

The concept of Life Cycle Cost Management is not new. According to Blanchard (5:1), industries, businesses, government agencies, institutions, and individuals have been dealing with development, production, and support cost components for years. Those costs were, however, viewed in a somewhat fragmented manner (5:1) with very little attention being directed toward the overall cost of a system.

Tighter budgets and a total cost consciousness on the part of consumers have forced many organizations, especially those in the defense industry, to become more conscious of total system cost. This cost consciousness calls for an aggregation of those historically fragmented costs into a more complete and visible total cost estimate. The name for this total cost philosophy is life cycle costing.

Within the Department of Defense (DOD), the evolution of Life Cycle Cost Management, or life cycle costing as it was commonly referred to, began back in the early 1960s primarily because of an increasing concern over the consequences of competitive procurement without regard to life cycle cost (17:1-6). In the early 1970s, a shift from the independent consideration of development, production, and support costs to considering total cost growth took place within the DOD. With the advent of complex weapon systems that were more

costly to procure and maintain and the degradation of our defense budget, the Office of the Secretary of Defense (OSD) began to take the problem of system life cycle cost more seriously. Specifically, the OSD began to realize that Operating and Support (O&S) costs were making up a majority of the total cost on specific aircraft systems (3:2). The OSD also realized that higher O&S costs were, in large part, the result of the greater complexity of each system. The added complexity tended to increase performance but reduced system reliability, thus increasing system O&S cost. As a result, fundamental examinations of the traditional methods and concepts of procurement took place (3:1). The OSD moved to define objectives for LCC Management, to provide technical tools for cost estimating such as models and definitions, and to assign appropriate responsibilities and tasking to the major commands (3:1). More consideration was given to system operating and support costs by examining, early in the design phase, the potential impacts of overhaul activities, personnel/system interfaces, and system reliability and maintainability parameters. Finally, a strong interface was established between the DOD and industry in order to open discussion on the real incentives needed to motivate designs with adequate reliability and lower life cycle costs (3:3). The result was a major transition from the emphasis on designing for unit production cost to an emphasis on designing for total system life cycle cost.

Today, Life Cycle Cost Management is one of the keystones in the DOD management strategy to control the increasing costs of defense systems (17:1-1). It is a goal oriented management concept which espouses: (a) the analysis of potential high cost areas in all program phases; and (b) the control of those high cost areas through internal program management practices, contractual requirements, and product performance agreements such as warranties, guarantees, and other incentives. Goals are usually established for measurable cost elements such as average unit production cost, maintenance manhours per flying hour, operational reliability, mission success probability, and average fuel usage (17:1-1). The concept is centered around a systems management approach which advocates the control of system reliability and maintainability, and the use of an approved maintenance concept and operation scenario to ensure that only the most effective weapon systems are procured for the United States Air Force.

Life Cycle Costing as a Systems Approach to Acquisition Management

According to Albanese, anything can be viewed as a system (1:481). An automobile is a system with hundreds of parts; a flower is a botanical system; and a human, probably the most magnificent of all systems, is both a physiological and physical system composed of a heart, lungs, brain, and so forth. Organizations, too, are systems and the list goes on. Each system is constrained by, and interacts with, an

environment and has boundaries that separate it from other systems. Albanese also notes that a system must be delineated by identifiable boundaries from its environment; those elements outside the boundaries are the external environment and those within the boundaries are the internal environment (1:483). When considering such a system, Schoderbek believes that it is extremely important that one look at all of the impacts of the system on the environment and vice versa (21:10).

This systems view is commonly referred to as the Systems Approach to Management or General Systems Theory (GST). The Theory, according to Albanese, is an all encompassing way of looking at wholes wherever they are found (1:480). Two main aspects of GST which Albanese cites are: (a) "system science" which is the exploration of wholes or wholeness, and (b) "system technology" which includes the techniques and models of system design and engineering (1:480).

Life Cycle Costing or Life Cycle Cost Management planning is, in many ways, consistent with the General Systems Theory. It concentrates on controlling the whole cost of a weapon system rather than its constituent costs. Also the LCC Management philosophy incorporates the use of models and techniques similar to those used in Systems Engineering. The consistency between GST and LCC Management continues in that each philosophy has been hampered in its development by a lack of adequate implementation.

Although the systems approach is not new, it is difficult to implement. Implementation is difficult, according to Schoderbek, because it implies some form of departure from the traditional form of management so successfully employed with simpler problems (21:8). That form being the analytical management approach which examines problems primarily through their constituent parts (21:8). Albanese, on the other hand, feels that there is a lack of implementation because the problem of identifying system boundaries can be a difficult one for a majority of managers (1:483). In any case, each argument presents a legitimate management concern when trying to manage systems using the systems approach.

Air Force managers are also faced with the problems identified by Albanese and Schoderbek when implementing LCC as a systems approach to acquisition management. If one agrees with Albanese's view of a system, then it is feasible to consider a piece of defense equipment a system. One might agree then, as Schoderbek would, that Air Force managers would suffer by having to consider a procurement management approach consistent with GST because it might incorporate a management approach quite different from the traditional procurement management approach. By taking the argument further, one might find that problems in the implementation of the LCC Management philosophy might also occur because: (a) the manager fails to consider the whole of the

system and its impacts on the environment, and (b) the manager feels apprehensive about using the newer, more complex models and techniques needed to evaluate the system.

Goals as Part of the LCC Management Structure

Goals are the foundation of the planning and controlling functions of managers; managerial planning and controlling are impossible without goals, and both of these functions are essential to efficient and effective management (1:48). Life Cycle Cost Management, like other management concepts, advocates the extensive use of goals as a strategic managing device. Goals, or more specifically, cost-related design goals must be established by Milestone I of the Acquisition Cycle, and "must be treated as management control devices with regular tracking and status reporting at program reviews [11:3]." The development and establishment of goals to control LCC serve other useful functions as will be discussed below.

Although the final result of the goal setting process are goals that are measurable, attainable, acceptable, and congruent with other management objectives (17:1-1), the effectiveness of goals is not attributable solely to the goals themselves. In Albanese's view, the ingredients that make up the means for achieving the ends (goals) are also crucial (1:61). In other words, the process of goal development can be beneficial in that it requires decision makers to explore significant management areas and make well planned

decisions concerning those areas. For Life Cycle Cost Management, those crucial ingredients include: program planning such as delivery and test schedule development; reliability, maintainability and performance requirements; and decisions concerning optional maintenance concepts. The processes involved in accomplishing each of these tasks are, in a large part, responsible for the establishment of a viable Life Cycle Cost Management program because the manager, in accomplishing these tasks, has in essence managed for life cycle cost. The result is a Life Cycle Cost Management concept which not only incorporates goals as targets for performance, but which also uses the goal development process as the basis for the management program itself.

Summary

This section has concentrated on the Life Cycle Cost Management philosophy. The concept was born during a revolutionary time in the Air Force--a time when system supportability was the order of the day and total system cost was quickly becoming the constraint on system acquisition. Further, the systems approach to management and the process of goal setting cannot be overlooked since these factors have a significant impact on the development of the LCC Management concept. The result is a LCC Management concept based on sound management principles and in tune with the needs of the Air Force.

Life Cycle Cost Management Implementation

This section considers the implementation of Life Cycle Cost Management in Air Force acquisition programs. Information is provided concerning the prescribed management actions to be taken during the procurement life cycle to ensure that

> Air Force personnel consider the full impact of life cycle costs in decisions associated with the selection, design, development, procurement, modification, repair or use of defense material [11:1].

Positive actions taken to implement Life Cycle Cost Management in an acquisition program include:

1. Identification of system cost drivers
2. Performance of LCC trade-off analyses
3. Establishment and approval of cost goals (10)
4. Development of a life cycle cost estimating, tracking and status reporting system
5. Use of acquisition strategies and contract commitments which support LCC Management objectives (8)

Each of these actions is addressed in this section of the literature review.

Identification of System Cost Drivers

Through 1978, there was no Air Force policy requiring the identification of life cycle cost drivers, and managers avoided such identification because of the complexity and difficulty of the process. Specifically, it was felt that the large amount of components included in a

complex weapon system, and the many operational considerations which had an impact on cost, would prohibit a legitimate cost driver identification program. However, at the end of the decade managers began to realize, based on lessons learned, that the control of certain system cost drivers could yield significant acquisition and O&S cost savings for a system. The change in the way of thinking occurred when the principle of "Pareto Optimality" was applied to the problem. Although the stimulus (person) responsible for applying the concept of "Pareto Optimality" to defense procurement is not known, early LCC applications on Air Force programs was advocated by such LCC theorists as Lavern Menker, Perry Stewart, and John Gibson.

In general terms, the principle states that each system contains a relative few operational considerations and system hardware items which account for the bulk of the total system life cycle cost. Specifically, these "cost drivers" account for as much as 80% (or more) of the total system LCC (18). That way of thinking espoused by those early LCC theorists facilitated the identification of cost drivers by reducing the total number of items considered for LCC reduction, and provided for enhanced control of life cycle cost by the program manager. Furthermore, that way of thinking is now seen as the basis for the current Air Force policy which states,

> Life Cycle Management efforts will stress the identification of factors or components which have a significant impact on life cycle cost results, and the implementation of trade studies to evaluate alternative actions which could reduce the impacts of such factors [11:2].

Cost drivers can encompass all program considerations from fuel consumption rates to system hardware. Acquisition cost drivers are identified in terms of their high item cost, and operating and support (O&S) cost drivers are identified by their component reliability, maintainability, availability, and performance criteria. For whatever category the drivers are identified, they will serve as the basis for a trade study process which will lead to cost related design goals and reduced system life cycle cost.

Performance of Life Cycle Cost Trade-Off Analyses

Throughout the acquisition process, especially in the early program stages, program managers and engineers make many decisions which have a significant impact on system life cycle cost. To make those decisions, decision makers rely on a great deal of pertinent information gathered and provided to them by experts in all functional areas. For the functional experts in the area of Life Cycle Costing, that information gathering starts with the cost driver identification process discussed in the preceding paragraphs and ends with the performance of life cycle cost trade studies.

Life cycle cost trade studies are crucial to the

overall effectiveness of the LCC Management program because they are the primary means of identifying significant concerns which could impact system life cycle cost. Blanchard (5:73) identified nine primary areas in which trade-off studies to evaluate alternatives should be conducted:

1. Alternative system/product operational and environmental profiles

2. Alternative system maintenance concepts and logistics support policies

3. Alternative system design configurations

4. Alternative procurement sources and the selection of a supplier for a given item

5. Alternative production approaches

6. Alternative product distribution channels, transportation and handling methods, and warehouse locations

7. Alternative logistics support plans

8. Alternative product disposal and recycling methods

9. Alternative management policies and their impact on the system

It should be clear then, that trade-off studies are not limited strictly to cost issues; rather, they encompass all areas which have potential impact on system life cycle cost.

Trade studies can be performed "in house" or can be conducted as part of system validation or development contracts. For the most part, LCC trade studies are a common

requirement in many development programs. The overall process for implementing contracted trade studies usually includes government requests that offerors prepare LCC trade studies to be used in both the contractor's and government's evaluation of a proposal. Most importantly, the trade studies serve as the basis for contractor proposed goals and design targets. As such, great importance is put on trade studies, and incentives such as award fees are used to motivate contractors to use trade studies in order to increase system cost effectiveness.

In accomplishing internal trade studies, the program manager must realize the constraints on the analysis. According to Blanchard (5:76), the manager must: (a) completely understand the problem area being investigated, (b) must dismiss any biases affecting his study, and (c) ensure that all studies are accomplished in the designated time period compatible with the analysis objectives. The manager must also consider the external and internal constraints of the system. Examples of these constraints include performance features, operational requirements, and maintenance concepts. Illustrations of how constraints on reliability, weight, and availability parameters limit the area of trade-off analyses are provided in Figure 2-1 (5:76) below. Finally, the LCC manager must choose an appropriate evaluation tool with which to conduct the trade studies. Current guidance suggests that cost algorithms contained in such models as the AFLC

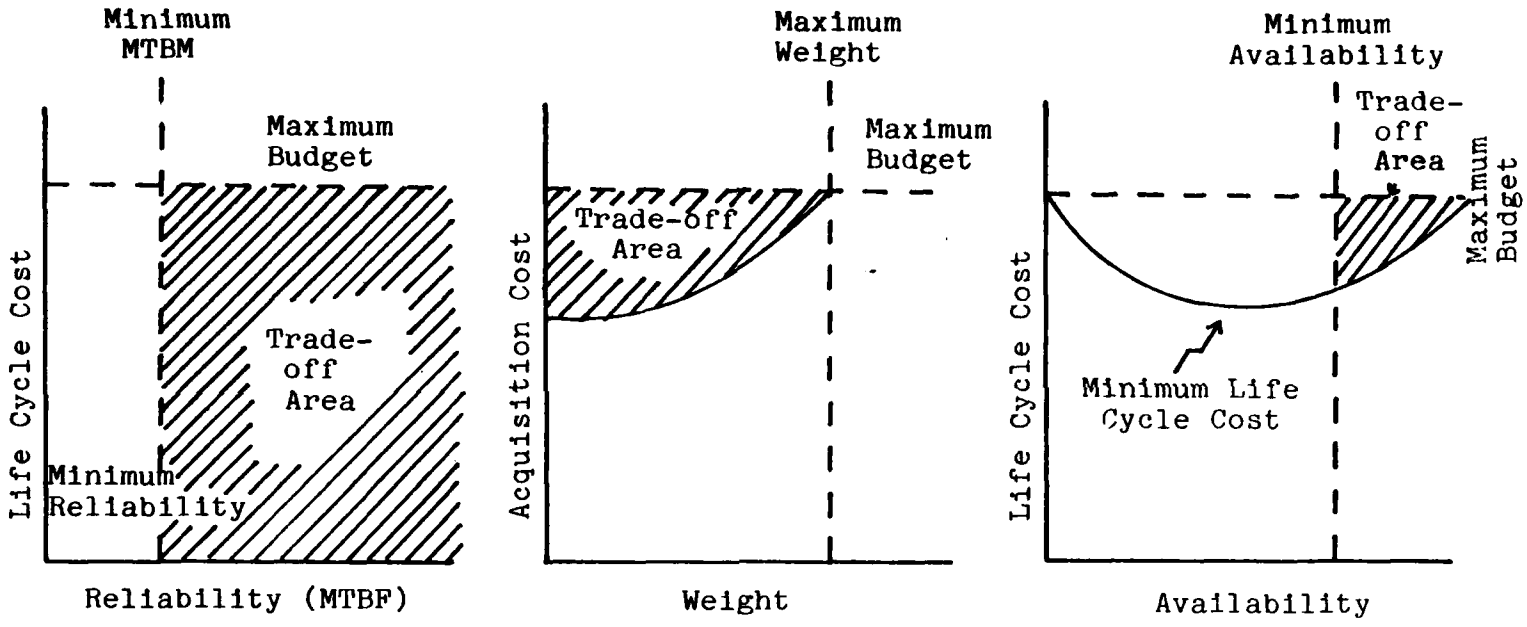

Figure 2-1. Trade Study Constraints

Logistics Support Cost Model (LSC) and the Cost Oriented Resources (CORE) Model are the most appropriate for this purpose.[1] Armed with the established constraints and the approved models, the LCC manager is able to provide much needed LCC information to the program manager. More important, however, is the fact that the information gained through trade studies will serve as the basis for the establishment of system cost related design goals.

Establishment and Approval of Cost Goals

For the Air Force, LCC Management goals or cost related design goals are defined as management objectives which are stated in terms of cost, or in terms of another parameter which can be directly related to cost, and are trackable either by direct measurement or by analysis (16). The identification and establishment of these goals start coincident with program inception. They are established to support the overall objectives of life cycle cost reduction over predecessor systems and provide management visibility and control throughout the acquisition process (16). As stated in AFR 800-11,

> Cost related design goals must be established by Milestone I and updated by Milestone II. Goals must be approved by the highest management level that will exercise regular review authority over the program. Treat approved goals as a management control device,

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[1]This statement concerning current guidance is consistent with policies released by ASD/ACCL.

> with regular tracking and status reporting for program reviews. Such goals will not be breached or relaxed without the approving authorities knowledge and concurrence [11:3].

Goals may differ depending on the program, but in most cases goals will be established for (11):

1. Average unit production cost
2. Unit operating crew and maintenance manpower requirements
3. Operational reliability and maintainability parameters
4. Selected design controllable factors which significantly affect life cycle cost such as average fuel consumption and mission completion success probability

They are usually established from stated program requirements, LCC trade study analyses, and from analogy with existing systems.

Design to acquisition cost goals are established early during the conceptual phase and are quite general at that time. They are developed strictly by program direction and analogy (16). At the early stages, the goals simply reflect affordability ceilings for system acquisition cost and are used primarily to guide study efforts (16). As the program progresses through subsequent phases, the top level goals are broken down to subgoals for subsystems and components representing lower levels of the System Work Breakdown Structure. These subgoals are consistent with and lend

strength to the top level goals. This goal setting process finally culminates with the establishment of a design to cost goal for the average unit production cost for a specific quantity of end items.

Operating and support cost goals, in contrast to acquisition cost goals, are established for parameters that contribute to cost savings rather than representing cost factors for anticipated O&S costs. Reliability and maintainability goals are key O&S cost goals because increased system reliability usually results in significant O&S cost savings, as illustrated in Figure 2-2. Reliability and maintainability (R&M) goals are established consistent with, if not the same as, those developed to fulfill the requirements of the Reliability and Maintainability Program specified in AFR 80-5. As it is currently written, AFR 80-5 states that the R&M Program will provide for the "establishment of realistic R&M goals and objectives to be addressed as major performance parameters for each system and evaluation at each program decision milestone [9:1]." Expert judgement and analysis are used to weigh system R&M goals against other program considerations such as system performance. This decision process is driven by the minimum system requirements on the one end, and by unattractive cost versus savings on the other end (16). R&M goals can be established during all acquisition phases up through the Full Scale Engineering Development (FSED) phase, but their effectiveness is increased when they

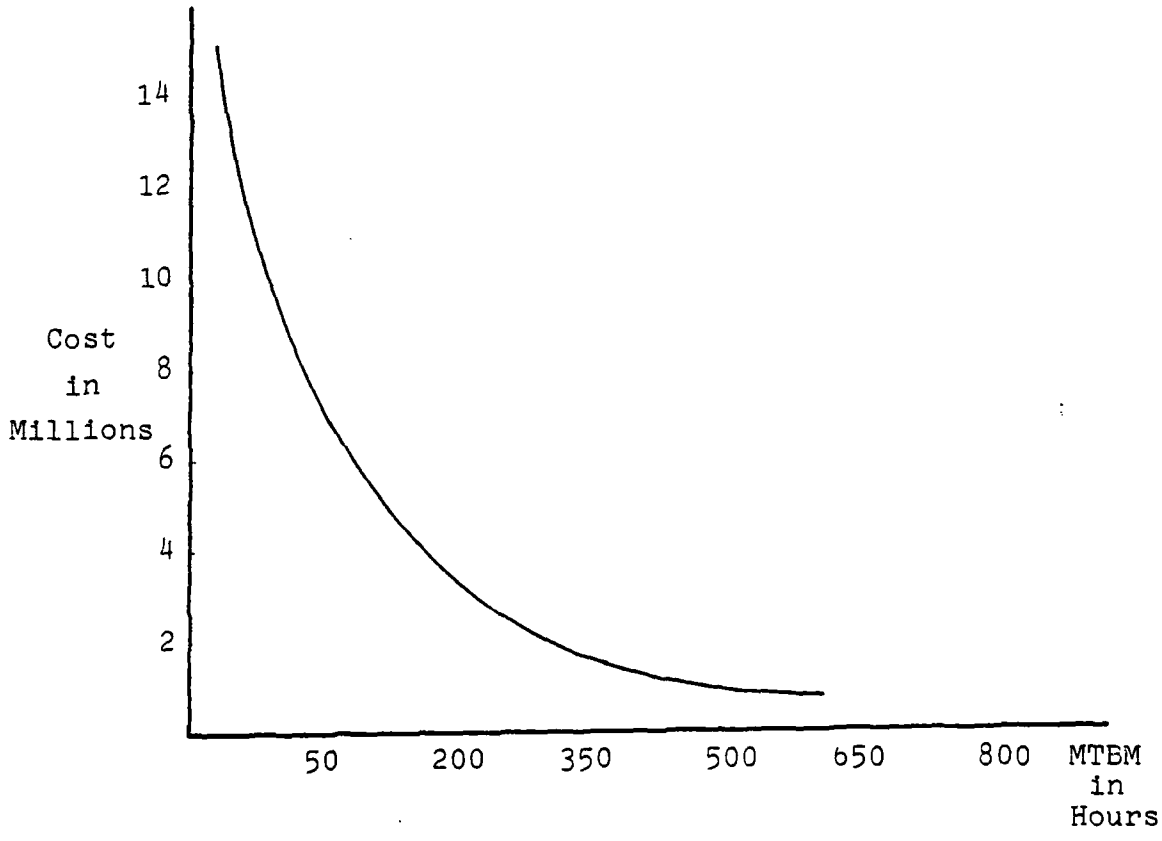

Figure 2-2. Reliability Versus Spares Cost

are established early in the program acquisition cycle. Reliability goals usually include system level goals such as Maintenance Manhours per Flying Hour (MMH/FH) and component goals such as Mean Time Between Removal (MTBR) and Mean Time Between Demand (MTBD).

Other goals used to reduce system operating and support costs are established in a more straightforward manner. Such a goal would be that used to control system fuel consumption. The fuel consumption goal must reflect the projected system usage in gallons or pounds per hour so that it can be converted to total fuel cost. This usually includes the specification of a total flying hour program and a representative mission for the aircraft system (16). Once the goal is established it can be easily converted to cost by multiplying it by the appropriate fuel cost factor.

Development of a Life Cycle Cost Estimating Tracking and Status Reporting System

An essential element in the management of an acquisition program is a system to facilitate tracking and report progress in meeting Life Cycle Cost Management objectives (18). The system closely resembles those managerial accounting systems used in the commercial sector with the exception of the accounting practices used in each case. The tracking and reporting system, like those used in the commercial sector, is essential to an Air Force program in that it provides for the on-going review, evaluation, and control of

program life cycle costs (5:179). The establishment of such a system is required of both the program office and the contractor, with each having specified LCC tracking and reporting responsibilities. A discussion of those responsibilities follows.

A responsive contractor LCC tracking and reporting system can provide cost visibility to the engineering decision makers so that they can maintain increased control over the system cost parameters (17). Obviously, it is appropriate for the contractor to participate in the LCC tracking and reporting system because he is the one designing the defense system. A primary purpose of the tracking and reporting system is to sustain visibility and generate further analysis of cost-related design goals established early in the program (18). Also, each high cost item identified at source selection is assessed for changes in status and subjected to an in-depth analysis in order to determine appropriate actions needed to reduce their cost impacts.

Guidance set forth in AFR 800-11 requires that program/project managers ensure that the contractor establishes and carries out an LCC tracking and reporting program. The effectiveness of such a program can usually be assessed during Program Management reviews, Preliminary Design Review, Critical Design Reviews, and prior to other key program milestones. Current guidance established by the AFSC/AFLC Joint LCC Steering Group requires that during each Program

Management Review, the contractor be tasked to address: (a) Life Cycle Cost Implementation plans and status of key activities, (b) cost drivers and actions being taken or planned to reduce life cycle costs, (c) the status of cost-related design goals, and (d) trade-off studies recently completed, those that are ongoing and those planned.

To assist the contractor in establishing an LCC tracking and reporting system and to ensure contractor compliance in this area, Air Force product divisions have established guidance which is included in various contractual instruments such as the Statement of Work. At the Aeronautical Systems Division, guidance established by the Life Cycle Cost Management Division (ASD/ACCL) has been found to be quite appropriate for assisting program offices in conveying their desire for a contractor tracking and reporting system. This contractual guidance includes requirements for the establishment of a Life Cycle Cost Management Plan, a Life Cycle Cost Estimate, Hardware Cost Contributors, Cost Related Design Goals, LCC Assessment Plans, and a Design Change Track.

The contractor-submitted Life Cycle Cost Management Plan is required as the contractor's primary plan for controlling system life cycle cost. The plan is to describe the contractor's approach for making life cycle cost an integral part of his management and design efforts. In all

cases, the contractor is required to address the following areas in the plan:

1. A statement of the contractor's life cycle cost management objectives and a description of supporting tasks, milestones, and responsibilities

2. Program management structure, policies and procedures, and functional interrelationships for maintaining life cycle cost visibility and control

3. Methods for determining and identifying LCC drivers and issues subject to trade-off analyses

4. A preliminary list of the ten most influential contractual requirements such as performance, schedule, standards, and specifications that affect the life cycle cost of the system

5. The identification and description of planned analysis methods and techniques to be used in any LCC analyses

6. Management and methodology for integrating subcontractor efforts into LCC management efforts

7. Recommended cost-related design goals and planned allocation procedures.

8. The planned feedback mechanism for tracking and reporting cost-related design goals and status, including proposed analysis and test and evaluation efforts to monitor progress

Initial plans are usually provided in response to Air Force

Requests for Proposals (RFPs) and are then evaluated for merit during the normal Source Selection process. Once selected, the contractor is usually required, as part of the data requirements, to submit revised plans when they are appropriate. Through this mechanism the Air Force hopes to ensure that plans are developed and adequately maintained throughout the program acquisition cycle. The LCC estimate forms the basis of the life cycle cost tracking and reporting system. The estimate, like the LCC Management Plan, is required of the contractor through the RFP, with updates to that estimate required as part of the Statement of Work and contract data requirements. The estimate documentation is required to include:

1. An introduction, including the purpose of the estimate, scope, and personnel involved

2. A system summary

3. A program schedule summary

4. The groundrules and assumptions used in developing the estimate

5. The estimate summaries for Research Development Test and Evaluation (RDT&E), Production, and Operating and Support costs

6. The RDT&E estimate by Work Breakdown Structure (WBS) and by function

7. The Production estimate by Work Breakdown Structure (WBS) and by function

8. The operating and support costs by Cost Element Structure

9. Time-phased program costs

10. Funding spreads

11. Inflation Methodology and Indices

12. The LCC estimate track (after contract award)

13. Sensitivity analyses

14. Risk and uncertainty analysis

The estimate track includes a comparison to prior estimates and the analysis of reasons for differences. Any differences between the baseline estimate established at contract award and subsequent estimates should be quantitatively expressed (18). According to Blanchard (5:180), the estimate track can be best explained with the use of the curve shown in Figure 2-3 below. Such charts serve a useful purpose in identifying LCC trends in a program. Through the use of these and other analysis tools, the LCC estimate can be tracked to provide significant insight into the control being achieved over system life cycle costs.

Another more direct means of controlling system life cycle cost is achieved through the tracking and reporting of Hardware Cost Contributors and cost related design goal status. For cost drivers, tracking starts with the submittal of a rank ordered list of system component cost drivers at source selection or shortly thereafter. The list includes drivers which account for not less than 80% of the total

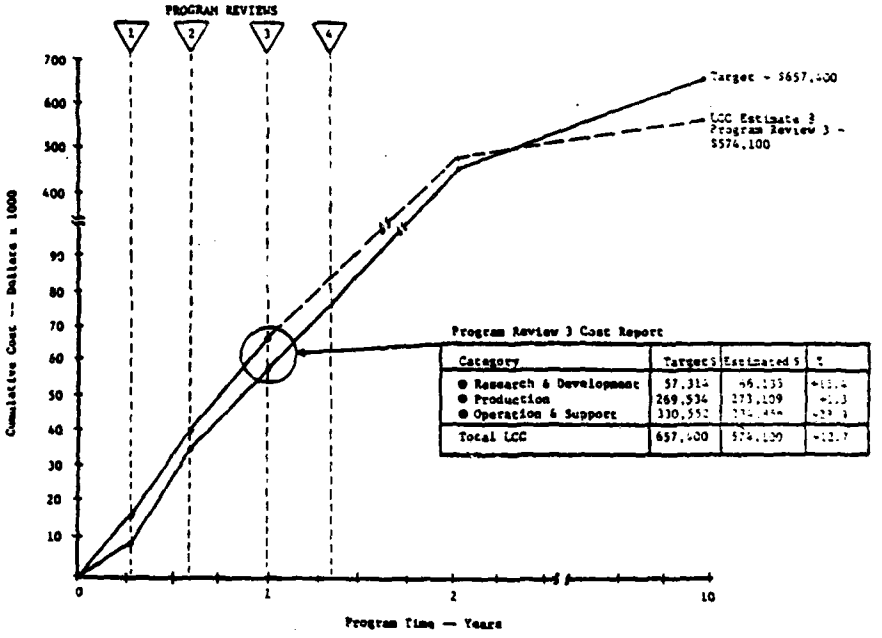

Figure 5-3 Program Life Cycle Cost Projection

Figure 2-3. Cost Estimate Track

estimated system life cycle cost. Cost driver status is to be reported at all program reviews along with proposed action to be taken by the contractor to control these items. Cost-related design goal status data is used to measure performance toward achieving the cost-related design goals and to provide projections and analyses necessary to develop timely management decisions concerning trade-offs and design changes. A unit production cost goal, for instance, is normally provided at the summary WBS level and then broken down to specific WBS elements. These elements include hours and dollars associated with each functional area such as: engineering, tooling, manufacturing, quality assurance, and purchased equipment. For non-dollar cost-related design goals such as crewsize, maintenance manpower, and operational reliability and maintainability parameters. the status reporting usually addresses the current and mature value of the goal and variances. A narrative analysis, delivered with the goal status report, usually provides the rationale for variances. That narrative is also used to provide a schedule for corrective action to be taken on goals not being achieved.

Finally, the contractor is required to submit LCC assessment plans and a design change track when appropriate or as requested in the data requirements. The LCC assessment plan is used to evaluate the LCC impact of selected approved program management, design, and operational alternatives observed to have significant cost implications. The

evaluation is achieved by tracking the implementation status of each proposed alternative through progress checks and testing activities. A design change track is used to provide a continuous track of design change activity. More importantly, the track and the associated reports are used as a means for estimating the impact of each contract and engineering change proposal submitted by the contractor. Specifically, LCC impact reports are required for each Engineering Change Proposal (ECP) or Contract Change Proposal (CCP) submitted under contract.

For the program office, LCC Management must be an integral element of the overall program management process. As such, LCC Management must be integrated into the acquisition strategy with planned management efforts documented in the Acquisition Plan and the Program Management Plan. The documentation of these efforts along with the identification of specific tasks, the assignment of responsibilities and the establishment of milestones for their accomplishment form the basis for program tracking and reporting. In addition to tracking and reporting these implementation efforts, other major activities are accomplished. These activities include:

1. Preparing and documenting an annual estimate
2. Maintaining an estimate track
3. Assessing and tracking contractor LCC estimates
4. Providing estimate traceability to program changes including the impact of approved ECPs, CCPs, and planned changes

5. Tracking the status of cost-related design goals and actions that are initiated to overcome significant variances

When using contractor information for tracking purposes, the program office can and should use the services of Defense Contract Audit Agency (DCAA), Defense Contract Administration Service, and Air Force Plant Representative Office personnel.

Use of Contract Acquisition Strategies and Contract Incentive Provisions Which Support LCC Management Objectives

Various acquisition strategies are followed for bringing new systems into the inventory. These strategies and their phases influence the decision making process and often the LCC of a system being procured (8). Although many programs follow a standard acquisition cycle which includes the Conceptual, Validation, Full Scale Development, and Production phases, there are times when modified acquisition strategies are more appropriate. These modified strategies contain differing procedures for handling successive acquisition phases and use different levels of competition through all phases. Changes in acquisition strategies may be preplanned or can be the result of reactions to events occurring in the program office on a daily basis. For whatever acquisition strategy is chosen, the program manager will have to assess its implications on system LCC and accommodate an LCC contracting strategy consistent with that acquisition strategy.

Life cycle cost contracting is a technique used to motivate contractors to design, manufacture, and deliver the most life cycle cost effective system. It is the primary means of ensuring that the contractor implement the necessary LCC Management actions already discussed in this section. As stated in AFLC/AFSC Pamphlet 800-34, LCC contracting is defined as (8:16-4):

1. Awarding a contract on the basis of lowest LCC, or

2. Including special provisions in a contract which are oriented toward reductions in LCC, improved operational reliability, reduced repair costs, or some combination of the above

The specific actions used to select a bidder with the lowest LCC contract and the special provisions used to provide an incentive for the contractor to lower system LCC are described in the paragraphs that follow.

The Defense Acquisition Regulation (DAR) recognizes lowest life cycle cost as the primary consideration for contract award. The Air Force must have a solid basis for evaluating the projected life cycle cost of a contractor's proposed system to make this award (8:16-4). According to the ASD Life Cycle Cost Management Division, the solid basis for this evaluation is achieved through:

1. The contractor's knowledge that evaluation for contract award will be made on the basis of system life cycle cost

2. The use of a government accepted Cost Element Structure (CES) and a legitimate analysis process which makes use of Air Force/Industry accepted estimating tools and methods

3. The use of a validated system data base for use in the LCC analysis. This data base is composed of both government standard data and system peculiar data supplied by the contractor in accordance with RFP

4. An assessment of the contractor's management structure showing that LCC Management will be a prime program consideration. Specifically, the contractor must address methods for achieving those areas previously discussed in this section such as the establishment of cost-related design goals, cost driver analyses, the development of an LCC Management Plan, and the development of an LCC tracking and reporting system

Although these requirements can vary slightly with each program, they nonetheless serve as the basis for a legitimate evaluation process.

The use of contract or LCC incentive devices is another method of achieving LCC objectives. Incentive provisions are popular, according to Casebere, because they serve to limit Air Force liability for substandard product quality or performance, to improve reliability on critical items, to motivate a vendor to exceed minimum acceptable requirements, or to accomplish a combination of these

objectives (7). To be effective an extended liability program must (7):

1. Cover a specific measurable period of time, or number of events, such as system operating hours, operational years, and number of landings

2. Identify specific features that are to be warranted or improved and the associated measures of performance

3. Be simple to administer and enforce

4. Be tailored to the peculiarities of the item being warranted and to the type of production contract

5. Be achievable by the contractor

6. Be obtained in a competitive environment

7. Contain enforceable remedies for non-performance

There are many types of incentives used to achieve extended liability. AFLC/AFSC Pamphlet 800-35 (8:16-4,5) cites award fees, support cost guarantees, and Reliability Improvement Warranties (RIW) as examples.

An award fee is a contract provision under which a selected amount of potential fee is set aside and provided to the contractor, based on subjective evaluations made at discrete milestones by the government. The evaluations consider how well the contractor has performed with respect to reducing life cycle costs (17:4-10). Award fees can be applied to one or more activity areas, such as LCC Management Plan implementation results, trade studies, or test results demonstrating potential for eventual LCC reduction. The

basic purposes of an award fee are to direct attention by the highest levels of the Air Force and industry to contracting for performance; to maintain Air Force and industry interest and involvement; and to provide for communication to a high enough management level to motivate extraordinary results (8:16-4).

Warranties, warranties with MTBF guarantees, and support cost guarantees are other examples of special contract provisions used to provide controls and contractual commitments on selected aspects of Operating and Support costs (8:16-5). Unlike award fees, however, these incentive provisions require an incremental financial commitment by the Air Force. The most noted of these incentives, the Reliability Improvement Warranty (RIW) and the RIW with MTBF guarantee, are oriented toward improved logistics reliability and reduced repair cost on selected components. In general, an RIW will provide for the repair or replacement of failed units as well as no-cost engineering changes and the associated calibration adjustment and testing (17:4-9). It is not, however, a maintenance contract. Support cost guarantees require a commitment by the contractor on a broader range of equipment capabilities than affected by individual components alone. They incorporate carefully defined logistics support cost targets which are validated based on actual experience with equipment under contract (17:4-9).

Award fees can be provided for exceptional performance

outside, or in addition to, the price of the guarantee. Poor performance, however, will require the contractor to provide compensation to the government. That compensation is usually in one of four forms: hardware correction of deficiencies, downward price adjustments on specific production quantities of the item, no-cost additional spares, and ceiling prices for item repair.

Maximum motivational and design benefits to be achieved with contract incentives can only be attained if the incentive program information is included in each phase of the acquisition life cycle. Positive performance incentives should be planned for early in the acquisition program since the earlier the producer knows that warranty/incentive coverage of some sort will be required, the more likely the government ensures that steps will be taken to design a life cycle cost effective product to meet the incentive obligations.

Summary

The purpose of this section was to highlight those prescribed management actions which ultimately lead to a legitimate LCC Management program within a System Program Office (SPO). The prescribed actions include the identification of system cost drivers; performance of LCC trade-off analyses; establishment and approval of cost goals; development of a life cycle cost estimating, tracking, and

status reporting system; and the use of acquisition strategies and contract commitments to support LCC Management objectives. Each action was described in context with the environment in which it is implemented so that a more complete understanding of the implementation process could be obtained. The final section of the literature review pertains to the implementation status of LCC Management.

Life Cycle Cost Management Status

This section includes a discussion of the current implementation status of LCC Management at the Aeronautical Systems Division (ASD). The discussion centers around the findings of an Air Force audit, performed between 22 September 1980, and 20 February 1981, concerning the timeliness and effectiveness of LCC Management requirements and considerations on selected programs at ASD (22). The audit cites the fact that more management emphasis is needed in the areas of: (a) LCC Management planning, (b) LCC Management guidance, (c) contractual implementation of LCC Management, and (d) LCC tracking and reporting. The current status of each of these problem areas is addressed in the paragraphs that follow.

LCC Management Planning

Life Cycle Cost Management planning, as reflected in Program Management Plans (PMPs) and other internal program planning documents, is incomplete, untimely, and lacks sufficient detail to ensure a viable LCC management program.

Specifically, LCC planning in a majority of program offices does not sufficiently address all of the minimum planning requirements set forth in paragraph 4a of AFR 800-11. Areas of concern cited in the LCC Management audit, which are still problem areas today, include:

1. A lack of information concerning what part LCC considerations play in the program decision making process

2. The lack of a planned method for establishing and updating cost-related design goals as required by DODD 5000.28 and AFR 800-11

3. A lack of information concerning anticipated major trade-off studies

4. A lack of information concerning life cycle cost estimating, tracking, and verification procedures to be utilized in the program office

An additional problem area is that few program offices have plans to integrate the complementary functions of LCC Management. These functions include: Integrated Logistics Support, Logistics Support Analysis, Value Engineering, and Interim Contractor Support. These planning problems exist, for the most part, because of the lack of effective LCC guidance and poor LCC training as discussed in the following paragraphs.

LCC Management Guidance

Current Air Force LCC Management guidance is inconsistent. Specifically, AFR 800-11 does not adequately

implement the life cycle cost reuirements of current DOD Directives (such as DODD 5000.28) nor does it comply with direction provided by the Office of Management and Budget (13) (OMB Circular A-109). The inconsistencies result because current LCC guidance does not require that life cycle cost be considered on an equal basis with schedule and performance. Along with this lack of consistency is a general lack of sufficient emphasis on Life Cycle Cost Management in formal program direction such as Program Management Directives (PMDs) and AFSC Forms 56. That formal guidance neither adequately addresses LCC as an important issue to be implemented by the program manager, nor places LCC on the same level of importance as performance and schedule. The result, as my experience as an LCC anlayst would lead me to believe, is a lack of integration of LCC Management requirements into the weapon system acquisition process.

The problem created by this lack of integration stems from the idea that program managers have the job and career related incentives to meet those program constraints which are most visible, namely performance and schedule. Since there is no coordinated guidance requiring that LCC be considered equal to those two constraints, program managers usually neglect LCC in lieu of more pressing issues. At times, the LCC Management function is deliberately subordinated to make program funds available to correct problems in performance or slippages in schedule.

Compounding the problem is a general lack of "how to" guidance concerning procedures for the accomplishment of LCC objectives. Current directives and regulations only provide general policy guidance tailored to major system acquisitions. There is little guidance for tailoring an LCC Management program to less-than-major weapon systems which do not have classically phased acquisition cycles. At the working level, there is a critical lack of training for LCC managers and focal points. LCC Management duties and responsibilities are ill-defined, if they exist at all. More importantly, focal points do not receive legitimate training in areas crucial to their development and effectiveness as LCC spokespersons. These areas include (22:4):

1. How to select and use a life cycle cost model
2. Techniques for tracking life cycle costs
3. Proper documentation of LCC plans and efforts
4. Development of contractual inputs to ensure contractor compliance in LCC management
5. Obtaining cooperation, consideration, and an interface with other program disciplines
6. Procedures for how and when to establish cost-related design goals
7. A lessons learned program
8. How to perform total LCC estimates and their fundamental uses

There are indications that the problems cited above

will continue to lead to a deterioration of effective LCC Management at ASD until action is taken to correct them.

Contractual Implementation of LCC Management

The findings of AFAA Audit 975-10 noted the fact that LCC Management requirements were not included in contractual instruments on a regular basis. When the audit findings were originally published, deficiencies were cited in each of the following areas: (a) Requests for Proposal lacked the specificity necessary to ensure that contractors treated LCC equally with performance and schedule, (b) LCC/DTC incentive provisions were not effectively established, (c) DTC contractual provisions were ineffectively established, and (d) LCC/DTC data were inadequately required (22:40). Since the time of the audit, however, there have been significant improvements in the contractual implementation of LCC Management.

Specifically, all contractual inputs to RFPs concerning LCC Management are now provided by, and coordinated through, the ASD Life Cycle Cost Management Division (ASD/ACCL). The coordination and review process requires closer scrutiny of system LCC by the program office. This has resulted in increased emphasis on Life Cycle Costing in source selections, and has done much to eliminate deficiencies in contractual inputs concerning LCC Management. The contractual provisions concerning the establishment of cost-related design goals and LCC data requirements are also

strengthened by this process. Cost-related design goal candidates for such parameters as availability, reliability and maintainability, and average fuel consumption (when appropriate) are now established through the coordinated efforts of staff and program engineers, the program manager, and ASD/ACCL. As such, the goal candidates receive increased visibility as management tools because a coordinated management effort is used to develop them. Specific goal values are required from the contractor at the time of contract proposal, submissions are assessed for their legitimacy, and they are then specified as contractual requirements in the Statement of Work and System Specification. LCC data requirements have also been improved through modifications to the LCC data item (DIF-30203) included in the Contract Data Requirements Listing (CDRL, Form 1423). These modifications greatly reduce the submittal of unnecessary data by tailoring data requirements to a particular program. Therefore, only one of the three originally cited problem areas remains a current problem.

A problem still exists in the establishment of LCC/DTC incentives. Specifically, LCC/DTC incentives generally do not motivate contractors to reduce LCC in a majority of ASD programs. This problem occurs primarily because incentive or award fee clauses are inadequately structured or used. The audit cited the following problem areas which still exist to a great degree (22:40): award fees which are too

small, assessment criteria which are too broad, periods of assessment that are too long, and multiple incentives which compete against each other. It has been my experience, gained by sitting on many warranty evaluation boards, that the problems originate because of misconceptions about the use of such incentives and the improper planning used to develop and implement them. Moreover, the problems continue after the incentive provisions are established because the incentive provisions are usually so loosely written that proper control is never achieved. The result is a high cost warranty which does little to provide reimbursement to the government for poorly constructed items and does little to motivate increased performance on the part of the contractor.

LCC Tracking and Reporting

Probably the most significant problem noted by the audit team was the absence of an adequate LCC tracking and reporting system in a majority of ASD program offices. The problem is significant because it involves the deterioration of the base of a program LCC Management effort--that base being the timely review and control of system life cycle cost. The problem, according to ASD/ACCL, is one which is not easily solved because it involves a change to the fundamental management philosophy used at ASD. That philosophy advocates the control of the so-called primary program constraints of system performance and schedule. Compounding the

problem is a general lack of action taken by higher headquarters (both AFSC and ASD) to enforce the rules requiring that adequate LCC tracking and reporting be maintained.

There are three areas of concern pertaining to the lack of an adequate LCC tracking and reporting system during my experience as a member of ASD/ACCL. The first area of concern is that contractors are not providing sufficient life cycle cost data to allow for detailed evaluation and control of system life cycle cost. Specifically, the contractors are not providing all of the data required under the contract nor are they providing data in the required format. In most cases, the contractor data which is supplied is incomplete, inaccurate, and inconsistent with similar data provided as part of other functional data requirements.

The second area of concern stems from the fact that the program office's internal tracking system does not usually include provisions for assessing contractor performance in relation to the LCC baseline estimate of performance for meeting established goals and subgoals. Although steps are being taken to implement a legitimate tracking system at the time of contract award, there is little evidence that the system is being maintained in a legitimate manner. Reasons for the decay of the tracking mechanism are varied, but they all stem from a lack of operating procedures within the program office for tracking LCC and goal accomplishments. In many program offices, program managers cite a lack of LCC

analysis expertise as the main cause of the problem. Although this is partly true, there seems to be a general trend toward using inexperienced personnel as LCC focal points; thus, the lack of expertise persists. When tracking is accomplished, it is often not documented, or noted deficiencies are not controlled by the program office personnel. Further, there seems to be a significant lack of communication between the LCC focal point and other functional experts regarding the status of system parameters such as reliability and maintainability. Finally, there is no indication that LCC focal points or program managers are enforcing the contract data requirements. This only leads to a deteriorating tracking system and, more importantly, informs the contractor that LCC is not, in fact, a valid program consideration deserving utmost attention.

The third and final area of concern is the lack of provisions for tracking or assessing the LCC impacts originating from engineering change proposals being incorporated into a program. LCC focal points generally do not provide written assessments to configuration control boards regarding the LCC impacts of submitted engineering change proposals (ECPs). That problem is not seen as significant by program managers, however, because contractors also usually do not provide such assessments. When LCC impact assessments are provided, the Configuration Control Board usually does not take LCC into consideration when approving or disapproving

engineering change proposals. This condition results primarily from the lack of concern for controlling the acceptance of ECPs for impacts other than those originating from contract, performance, and schedule changes.

Summary

The purpose of this section was to provide a general understanding of the current implementation problems facing Life Cycle Cost Management at ASD. The discussion centered around the implementation problems cited in a recently conducted AFAA review of LCC Management in each product division of the Air Force Systems Command (AFSC). Problems cited at ASD were found in the areas of: (a) LCC Management planning, (b) LCC Management guidance, (c) contractual implementation, and (d) LCC tracking and reporting. Each problem area was investigated to reveal the depth and scope of specific problems, and potential reasons for their existence have been provided.

The information reported in this and the other sections of the literature review was combined with the knowledge gained from interviews with LCC focal points to develop the LCC Management Primer, included in Appendix A. The discussion of the interview responses is reported in the next chapter.

CHAPTER III

RESULTS OF INTERVIEWS

The purpose of this thesis is to develop a Life Cycle Cost Management Primer designed to provide practical information to Aeronautical Systems Division LCC focal points and managers. As explained in the methodology section of Chapter I, input for the Primer came from an extensive literature review and from informal interviews with LCC Management focal points located in various ASD program offices. The interviews were used to gather useful ideas for LCC Management from those personnel currently experiencing LCC Management problems. This chapter provides the results of the informal interview sessions.

Interview Methodology

The original plan was to conduct informal interview sessions with LCC focal points in all of the eight ASD program offices. However, permanent change of station (PCS) and temporary duty assignments (TDYs) resulted in the non-availability of focal points in three program offices during the interview phase of this research effort. As a result, interviews were conducted with eight focal points from the following five program offices:

1. Deputy for Airlift and Trainer Systems (2; 12)

2. Deputy for Tactical Systems (20)

3. Deputy for Strategic Systems (15; 19)

4. Deputy for Simulators (14)

5. Deputy for Propulsion (4; 23)

It is noted that while not all program offices were included, the five offices in the sample represented a cross section of ASD programs. Further, the eight focal points interviewed included four junior Air Force officers and four mid-level Civil Service managers. That particular sample of focal points was selected in order to gather ideas from both experienced and inexperienced personnel concerning the tools needed to effectively conduct an LCC Management program within a System Program Office (SPO).

Each interview lasted approximately 45 minutes, and the focal points provided confidential answers to each of the following questions:

1. Do you feel that you, as an LCC focal point, are a part of this program office's management structure?

2. How much assistance do you receive from the ASD Life Cycle Cost Management Division (ASD/ACCL)?

3. Do you feel that ACCL has been more of a help or hinderance to you in your job?

4. Do you feel that it is ACCL's responsibility to train you?

5. Do you develop LCC Management or cost inputs to program management and source selection documents, rely on

ACCL for inputs, or develop inputs with ACCL assistance?

6. Do you have sufficient knowledge about LCC Management or cost inputs?

7. Would you rather rely on example (boiler plate) inputs, or be trained to develop your own inputs?

8. Would you like to see a document with the kind of LCC Management inputs or general information that you need to do an effective job as an LCC focal point?

9. What ideas, if any, do you have for the contents of the document or Primer? How should the Primer be organized?

10. Should the Primer be restricted to the source selection proces, or should it be related to the entire acquisition process?

These questions were disseminated to all interviewed focal points approximately 10 days prior to the interviews. As a result, most of the responses were well prepared and to the point.

Discussion of Interview Responses

A discussion of the responses obtained during the interview sessions is provided in this section.

Question 1

Only two of the eight focal points feel that LCC Management is a legitimate management concern in their program offices (SPOs). For the most part, they believe that

LCC Management is viewed as an extra cost item which few managers completely understand. In fact, the focal points noted that most program managers think LCC should be ignored as a prime program consideration with attention focused on more pressing issues such as system performance, schedule, and budget considerations.

Question 2

The majority opinion is that ASD/ACCL does provide helpful assistance, but that the assistance is more often than not, untimely. Specifically, the focal points feel that the assistance comes too late to have an impact in the acquisition strategy of the program. Further, when advice and inputs are obtained, they are usually restricted because they are seen as costly controls which could adversely affect the program schedule and production costs.

Question 3

The majority of focal points feel that ACCL is a hinderance because it expects a level of expertise that few focal points have. As a result, requirements and requests made of the focal points are seen as extremely difficult, and sometimes impossible tasks. To compound the problem, little or no guidance is given to assist the focal points in accomplishing the required tasks.

Question 4

All focal points do not feel that it is ACCL's responsibility to train them. However, many of them believe that quarterly seminars and a more comprehensive LCC Management short course at the Air Force Institute of Technology is needed.

Question 5 & 6

The responses to these questions were mixed. Only the mid-level managers felt sufficiently confident of their knowledge of LCC Management to allow them to provide their own LCC Management inputs into such documents as the Program Management Plan, Source Selection Plan, and Request for Proposal.

Question 7

The majority of focal points noted that boiler plate/example inputs are a must, primarily because they save a great deal of time. However, that same majority feels that some guidance and background information should accompany the boiler plates in order that the focal points could more fully understand and justify their inputs.

Question 8

The interviewed focal points believe that such a document would be extremely helpful, especially for new focal points. They feel that a document with examples and practical

guidance would: (a) reduce the time needed to write LCC Management inputs, (b) increase the understanding of LCC Management tasking, (c) serve as a quick point of reference for short suspense requests concerning LCC Management, and (d) reduce the coordination time with ASD/ACCL for LCC Management inputs to program management documents such as the Program Management Plan and the Acquisition Plan.

Question 9

Each focal point expressed ideas as to the content of the Primer. It should be noted, however, that all focal points interviewed feel that such a Primer should be short in length and easy to read. Specifically, it should not be so long or contain the numerous acronyms that would inhibit its use by the novice LCC focal point. A major point was that the proposed Primer should contain examples of the LCC Management inputs to the primary program management documents as well as background information, so that an understanding of such inputs could be achieved. Some focal points suggested that the Primer contain numerous inputs representing all types of weapon systems and that a section describing product performance agreements be included as well.

Question 10

The interviewed focal points believe that the Primer should encompass the whole acquisition process, from pre-milestone I to program management responsibility transfer

(PMRT) considerations. They felt that such coverage would make the Primer a useful tool in all program phases, especially the early program phases where initial decisions concerning system development may still be influenced by LCC considerations.

As stated earlier, these interview results along with the information provided in the literature review were combined to form the basis of the LCC Management Primer contained in Appendix A.

CHAPTER IV

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

Life Cycle Cost Management is a management concept born from the need to procure more cost effective weapon systems. The concept espouses a systems approach to management which requires a decision maker to manage from a macro perspective as opposed to the more familiar micro perspective. In the Air Force, the LCC Management philosophy requires that the program manager look at more than the immediate program considerations of initial performance, budget, and schedule. Rather, it requires a total system perspective over an entire system life cycle. To many Air Force managers this macro perspective is very difficult to achieve because of the complexity of the programs which they manage. Also, the program manager's staff seldom have the technical or managerial skills to develop the tools needed to control a program at the macro level. As a result, the LCC Management concept, despite all of its potential benefits, is shunned by program managers and is seldom implemented in Air Force programs.

The problem of the lack of LCC Management implementation in the Air Force, and more specifically at the Aeronautical Systems Division (ASD), was made apparent during a

recent Air Force audit. The audit reported that the lack of LCC Management was due primarily to the lack of LCC expertise held by focal points located within ASD program offices. Specifically, the audit cited the fact that a majority of LCC focal points do not understand the LCC Management concept and how it should be implemented. The audit team offered numerous solutions to the Life Cycle Costing problems being experienced at ASD. Most notably, they suggested that practical guidance concerning LCC Management be issued to ASD focal points by the ASD Life Cycle Cost Management Division (ASD/ACCL). The LCC Management Primer developed as part of this thesis is a response to that suggestion and is designed to alleviate the LCC Management problems at ASD as described in the AFAA audit.

The LCC Management Primer has been developed from an extensive literature review and from personal interviews conducted with LCC focal points at ASD. The literature review encompassed some thirty-five documents and regulations concerning LCC Management in the Air Force. Specifically, the information drawn from the review was instrumental in developing an understanding of the LCC Management philosophy, for drawing conclusions as to how LCC Management should be implemented, and for assessing the current status of LCC Management at ASD.

The interviews, on the other hand, were conducted with eight LCC focal points representing five program offices at

ASD. The interviews, conducted in June and July of 1982, were designed to solicit each focal point's ideas as to the status of LCC Management within their program offices and to further identify the type of document needed to provide timely LCC Management assistance. As it turned out, the information drawn from the interviews was extremely useful, not only for developing the content of the Primer but for restricting the scope of the Primer as well.

Conclusions

The LCC Management Primer included as Appendix A to this thesis has been developed in response to the need for practical LCC Management guidance by ASD focal points. It has been designed primarily to provide the novice LCC focal point a basis from which to establish a viable LCC Management program. That basis includes general guidance concerning the use of such accepted management tools as goals, trade-off analyses, and management control systems. It also includes a description of the documents used in managing a program and how those documents can precipitate program cost effectiveness through their inherent LCC Management inputs. In fact, sample LCC Management inputs to the documents are included to make the job of implementing a strong LCC Management program easier.

In addition to the benefits provided to the novice, the Primer should also be of some benefit to more experienced

focal points. Specifically, the information provided in the Primer can serve as quick reference material for such key LCC Management elements as cost-related design goals. Further, the sample inputs should provide the expert with new or additional ideas for developing particular LCC Management inputs. More importantly, the Primer should be an asset in establishing a standardized LCC Management apprcach requested by senior ASD focal points.

Despite its potential usefulness, the Primer is not a stand-alone document. It will be most useful when used with other LCC implementation documents such as the "Operating and Support Cost Estimating Primer" developed by Major Tom May and the joint AFSC/AFLC "Product Performance Agreement Guide." Both of these documents, available through ASD/ACCL, provide excellent information concerning the O&S estimate process and contract incentive provisions. Taken together, the LCC Management Primer, the O&S Cost Estimating Primer, and the Product Performance Agreement Guide should form the library needed to guide the focal point in developing any LCC Management program.

Recommendations

The LCC Management Primer has been designed to fill a void which currently exists in LCC Management program guidance. This Primer, in conjunction with the Operating and Support Cost Estimating Primer and the Product Performance Agreement Guide supplied through ASD/ACCL, should provide the LCC

focal point with a long-needed library of LCC Management program guidance. There is, however, a void which still exists in the LCC guidance because the LCC Management Primer does not provide guidance for conducting an LCC Management program after contract award. The development of such guidance was considered to be out of the scope of the guidance included in the LCC Management Primer. It is recommended, then, that a separate primer be developed to address post contractual LCC Management requirements. It is further recommended that the Post Use Validation Survey, included as Appendix B to this thesis, be accomplished one year after dissemination of the Primer for ASD use. Any updates derived from that survey or other changes in DOD or Air Force LCC Management policy should be made to the Primer as needed.

APPENDIX A

THE LIFE CYCLE COST MANAGEMENT PRIMER

THE
LIFE CYCLE COST MANAGEMENT
PRIMER

CAPTAIN A. KENT DOUVILLE

NOVEMBER 1982

LIFE CYCLE COST MANAGEMENT DIVISION
DIRECTORATE OF COST ANALYSIS
COMPTROLLER
AERONAUTICAL SYSTEMS DIVISION
ASD/ACCL
WRIGHT-PATTERSON AFB, OHIO 45433

PREFACE

In his article "I Dreamed We Went Nowhere in Our Solid Gold Airplane," published in the January 1976 Defense Management Journal, O. C. Boileau stated,

> You don't have to be an economics expert to conclude . . . that DOD manpower and operations costs are chewing up the budget, such that in time there won't be money left for procurement.

Those remarks are even more pertinent today because of the increased scrutiny over and decreased buying power of our nation's defense budget. The Air Force, like other DOD components, can no longer rely on outdated methods of managing defense system procurement that neglect the importance of system support. As a result, current DOD policy directives and regulations based on observations like Boileau's are designed to make significant and needed changes in our procurement strategy. These changes include more consideration of operating and support costs or more appropriately, life cycle costs (LCC).

As with other changes in management structure, however, the LCC Management change process can be slow. That fact was recently noted in an Air Force Audit Agency (AFAA) audit report of the LCC Management function at the Aeronautical Systems Division (ASD). Among other problems with LCC Management, the audit team cited a major deficiency in implementing LCC Management programs because of the general lack

CONTINUED

of experience held by LCC focal points and managers within the program offices. According to the audit team, the problem was compounded since there was little practical guidance provided to each focal point concerning LCC Management at the working level. As a result, they recommended that the ASD Life Cycle Cost Management Division (ASD/ACCL) develop a Life Cycle Cost Management Primer to provide the practical guidance needed by program office LCC focal points. This LCC Management Primer is the fulfillment of that recommendation.

Comments and suggestions for improving this document should be addressed to ASD/ACCL, WPAFB, Ohio 45433.

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1.0 INTRODUCTION.

1.1 The Life Cycle Cost Management Concept. Life Cycle Cost Management is an acquisition management strategy used to ensure the procurement of defense systems which meet the operational needs of the Air Force at the lowest life cycle cost. The LCC Management concept is not new. Its evolution began back in the early 1960s as the result of an increasing concern over the consequences of competitive procurement without regard to total system cost. It is currently implemented in acquisition programs through formal policy contained in AFR 800-11. The policy requires that Air Force personnel consider the full impact of life cycle cost in decisions associated with the selection, design, development, procurement, modification, repair, or use of defense material.

The LCC Management concept is, in essence, a systems approach to management. It advocates the use of goals and other management techniques to control the current and future cost consequences, as well as the performance requirements and schedule constraints of a weapon system.

As such, LCC Management requires that all program functional areas become involved in a total commitment to control and ultimately reduce total system costs. That commitment requires the coordinated efforts of the program

and functional managers to:

(1) Identify factors which have a significant impact on life cycle cost results and implement trade-off studies to evaluate alternative actions that could reduce the impact of such factors.

(2) Select product design goals which help to control life cycle cost results.

(3) Choose acquisition strategies that support life cycle cost objectives.

(4) Select sources for development, procurement, or production which offer the optimal balance between product performance and life cycle cost.

(5) Establish contract commitments, when appropriate, to help in controlling life cycle cost results.

(6) Conduct follow-on efforts subsequent to acquisition to improve system life cycle cost control.

In summary, LCC Management is a means for maintaining, through all program phases, a balanced perspective of all program requirements, constraints, and costs.

1.2 Purpose. The purpose of this Life Cycle Cost Management Primer is to provide ASD personnel a tool designed to reduce LCC Management implementation problems in the program offices. Specifically, the Primer has been developed to:

(1) Help close the gap between the expertise that exists at the Comptroller level and the lack of

expertise at the program office level concerning Life Cycle Cost Management.

(2) Provide practical information to both the novice and experienced LCC focal points and managers.

(3) Provide a basis for LCC Management inputs to program office internal control documents and contracts.

(4) Provide justification for an effective LCC Management program within a program office.

1.3 Scope. The Primer is written primarily to assist LCC focal points and managers in developing timely inputs to the Program Management Plan, the Acquisition Plan, and the Request for Proposal (RFP). LCC Management inputs to the Source Selection Plan are also described in conjunction with the inputs to the RFP discussed in Chapter 4.

The Primer is designed under the assumption that its users will at least be familiar with the policies and procedures involved in the procurement of defense systems. Although that familiarity need not encompass an in-depth knowledge of the procurement process, it is assumed that the user will be familiar with the Program Management Plan, Acquisition Plan, Request for Proposal, and Source Selection Plan.

The Primer should also provide useful information and reference material to more experienced LCC focal points and

managers. It includes a general discussion of how each of the program documents described above is integrated into a system's Life Cycle Cost Management program. Furthermore, the Primer provides "boiler plate" LCC inputs to each of the program documents to facilitate the LCC Management effort. Although the Primer does provide useful "boiler plate" LCC Management inputs and guidance, the user is cautioned that the information, and especially the examples provided, must be tailored to specific programs.

2.0 LCC MANAGEMENT INPUTS TO THE ACQUISITION PLAN.

2.1 General. The principal purpose of the Acquisition Plan (AP) is to describe the overall strategy for the system acquisition concept developed by the program manager. Unlike the Program Managament Plan (PMP) which describes the management of an entire program, the Acquisition Plan (AP) describes the contracting for a program. The AP specifically focuses on contracting for a program and serves as the primary long-range planning document for the program throughout the contractual period. The AP is usually prepared by the Program Contracting Officer in coordination with appropriate program office personnel from each of the functional areas. Each of these functional areas is represented consistent with the Acquisition Plan format included in DAR 1-2100, as shown below.

NARRATIVE PORTION OF ACQUISITION PLAN

(1) Description of the program, item, or system.

(2) Program funding (R&D and Production) including a summary of funds in the FY DP/Budget Submission.

(3) Delivery requirements, both R&D and Production contracts.

(4) Applicability of a Decision Coordinating Paper (DCP) or Program Memorandum Defense System

Acquisition Review Council (DSARC) or Internal Service Reviews.

(5) Background and procurement history.

(6) Discussion of program risk, including technical, cost, and schedule.

(7) Integrated Logistics Support Planning Concept.

(8) Application of Design to Cost.

(9) Application of Life Cycle Cost (LCC).

(10) Reliability and Maintainability (R&M) objectives, including warranties.

(11) Test and evaluation approach.

(12) Management information/program control requirements.

(13) Approval for Operational Use.

(14) Government Furnished Material/Facilities/Component breakout.

(15) Application of Should Cost.

(16) Milestone chart attachment depicting the objectives of the acquisition.

(17) Milestones for updating the Acquisition Plan.

(18) Identification of participants in the AP preparation.

(19) Procurement approach for each proposed contract.

2.2 LCC Management Considerations. The consideration of system life cycle cost in an acquisition program is important

since a legitimate LCC Management program can contribute signficantly to the total cost and performance effectiveness of a weapon system.

Some senior and mid-level managers, however, feel that a LCC Management program's contribution is questionable since many of the benefits of a good LCC Management program are realized in later stages of the program and are hard to predict. Therefore, the LCC focal point must help management understand, in as specific terms as possible, how the application of Life Cycle Cost Management in the acquisition strategy will help provide the Air Force with a better weapon system. That help is the narrative discussion included as paragraph 9, "Application of Life Cycle Cost (LCC)" of the Acquisition Plan.

For the most part, paragraph 9 should include a discussion of the objectives of and the tools and techniques used in the LCC program, or in some cases why LCC considerations are not appropriate for the particular system acquisition. As a general guideline, some discussion should be included in each of the following areas:

(1) A brief discussion of the objectives to be achieved through the LCC Management program.

(2) Any cost-related design goals planned for use in procuring the weapon system.

(3) Any LCC trade-off analysis studies planned during the development of the system.

(4) A brief discussion of the LCC estimating (including a description of the model to be used, if possible), tracking, and reporting system to be used to control costs in the program.

(5) Any contract incentive provisions to be used to motivate increased contractor performance.

Remember that the "Application of Life Cycle Cost" paragraph is to be just that, so constrain the discussion to be brief and to the point. For instance, LCC program objectives should be stated in specific terms. As an example, areas such as fuel consumption, maintenance, manpower requirements, or replenishment spares requirements can be specifically mentioned as areas to be controlled to reduce costs. In most cases, fuel consumption and maintenance requirements are the most significant cost drivers for a major system. For less than major systems, areas such as replenishment spares requirements or maintenance requirements might be the high cost drivers. In any case, the focal point should try to focus management's attention on the specific areas to be controlled.

A major means of controlling costs is through the use of cost-related design goals. If appropriate, specific areas for which goals are to be established should be mentioned. If there is specific information on a model to be used in the LCC estimating/tracking process, then provide it. For example, the "Cost-Oriented Resources (CORE)" model

and/or the "Logistics Support Cost (LSC) model are used, in most cases, to estimate costs. Further, provide information concerning contractor support when utilized in the estimating process. Finally, be as specific as possible concerning the type of contract incentives that are planned for the acquisition. There are many different types, such as warranties, guarantees, and award fees to name a few.

When the focal point needs help in identifying the items just discussed, the needed information can usually be obtained from the functional area representative in the focal point's program office. Further guidance in structuring the inputs to paragraph 9 of the AP is provided in the sample inputs provided in Section 2.3, and additional help may be obtained by contacting the ASD Life Cycle Cost Management Division (ASD/ACCL). Documents which also provide useful information include: AFR 800-11, "Life Cycle Cost Management Program"; AFLC/AFSC 800-34, "Acquisition Logistics Management"; DAR 1-2100, the "Product Performance Agreement Guide"; and the "Operating and Support Cost Estimating Primer."

2.3 Sample Inputs. To assist the focal point in the development of Acquisition Plan inputs, six sample "Application of Life Cycle Cost (LCC)" paragraph 9s are provided below. The first is a generic input which includes, to some degree, all of the information previously discussed. The remaining five

are actual paragraph 9s used in prior Acquisition Plans. The five inputs were chosen because they represent a cross section of programs and should provide useful information for development of Acquisition Plan inputs.

Generic Input
9.0 Application of Life Cycle Cost (LCC). The objective of the _____ Life Cycle Cost Management Program is to minimize the total cost to the government of the _____ system, primarily through a reduction in unit production costs, maintenance manpower costs, and system fuel consumption. To achieve this, the program office will assess and require the contractor to consider the impacts on life cycle cost originating from reliability, maintainability, logistics, and performance considerations of the _____ system. The bidding contractors will be required to propose the use of comparable commercially used systems to decrease total costs and will be further required to identify major hardware cost drivers. Specifically, the contractor will be required to use LCC trade-off analyses to assess and reduce the impacts of the cost drivers on system life cycle cost. Cost-related design goals are also planned for average unit production cost, system reliability (MTBR), system maintainability (MTTR and MMH/FH), system availability, and average fuel consumption. The operational reliability, maintainability, and availability goals will serve as the basis for the proposed Award Fee program described in paragraph _____. Finally, a Reliability Improvement Warranty (RIW) is planned for the _____ avionics subsystem to motivate the contractors to provide a 50% improvement in the reliability currently experienced in the field (MTBR currently stands at 110 hours).

C-X Input
Design-to-Life Cycle Cost. Emphasis will be placed on Design-to-Life Cycle costs (DTLCC) with award fees (on management of the DTLCC Program) and incentive fees (on measurable elements of the Reliability/Maintainability Program) used to influence the contractor's effort to optimize the balance between development and production cost and the outyear cost of fielding, supporting, and operating the system. A single DTLCC goal will be expressed as the sum of the following four cost elements: Full Scale Engineering Development, Weapon System, Other Support, and Operating and Support costs. This concept will lead to designers and logisticians working together to design a system with minimum life cycle costs. It will be possible to trade off higher R&D or production costs against operating and support cost savings, thereby adding flexibility to optimize the balance between acquisition and operating costs. Life cycle costs will also be optimized by looking across other aircraft systems for opportunities to share common assets and standard equipment.

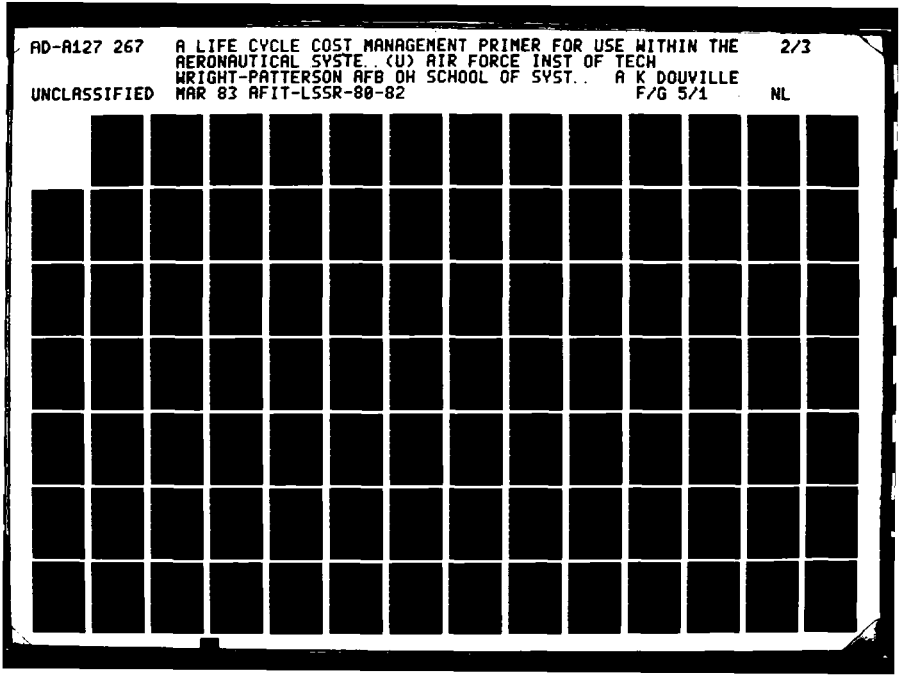
Standard Fuel Savings Advisory System Input
Application of Life Cycle Cost (LCC). LCC will be a major factor for consideration in the source selection process. The offerors will be required to propose prices for equipment with Organic Maintenance with a MTBF verification test and a Reliability Improvement Warranty (RIW) with a MTBF guarantee for five years followed by conversion to Organic Maintenance. AFRs 800-2 and 800-11 will be used in the construction of an LCC model. Life Cycle Costs will be used in cost-effectiveness studies impacting on procurement decisions and evaluations of Engineering Change Proposals (ECPs) in accordance with AFRs 800-3 and 800-11.

F-16 Fire Control Radar Input

Application of Life Cycle Cost (LCC). The life cycle cost of various improved radar options was considered as part of the requirements definition of the improved radar. The contractor is required to implement a life cycle cost management program. This includes: (1) a LCC trade study program; (2) a program of LCC design goals for unit production cost, reliability, and maintainability which the contractor is required to track; and (3) a program to assess the impact to LCC of any configuration changes. The contractor will also be motivated by a 12 million dollar reliability performance incentive and 500,000 dollar award fee for design efforts to improve reliability. The performance incentive will be based on measured reliability performance in the field.

H-X Input

Design to Life Cycle Cost. The objective of the Life Cycle Cost (LCC) program will be to optimize the total cost to the Government of development, production, support, and operation of the H-X system. Therefore, the program office will consider Design to Life Cycle Cost (DTLCC) within the constraints of budget, system performance requirements, and schedule throughout the design, development, and production of the H-X system. The H-X design will make maximum use of off-the-shelf equipment and existing mature technology with emphasis on seeking a balance between the costs of development and production versus the out-year costs of fielding, supporting, and operating the system. Management emphasis, exchanges of ideas on current problems, user inputs, etc., will all contribute to maintaining LCC awareness and involvement by both Government and contractor personnel. The program office will use contract requirements to task and motivate the contractor to implement a meaningful LCC program.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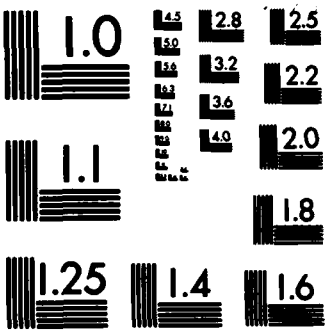

NGT Input
Application of Life Cycle Cost. Emphasis will be placed on Life Cycle Cost (LCC) during the Full Scale Development (FSD) phase based on the goals established as a result of the Concept Exploration study efforts and the contractor's plans for controlling system Life Cycle Cost. Cost-related design goals will be established for: unit production/modification costs; base level maintenance manpower; and the Operational Reliability, Maintainability, and Availability factors indentified in paragraph 10. The Operational Reliability, Maintainability, and Availability factors will also be used to structure the award fee program described in paragraph 19.h.7. Warranties are also being considered as a means of motivating/committing the contractor to provide operationally reliable, maintainable, and supportable equipment (see paragraph 19.h(14). Contractors will be required to identify major areas for potential LCC reduction and perform trade-off studies to reduce LCC in these areas.

3.0 LCC MANAGEMENT INPUTS TO THE PROGRAM MANAGEMENT PLAN.

3.1 General. The Program Management Plan (PMP) is the primary program management document used by the program office, participating agencies, and higher level decision authorities. The program manager is responsible for developing the PMP, usually with the help of all functional groups and using commands participating in the acquisition program. Its content is tailored to provide the minimum information needed to outline the overall management plan for the program. Most importantly, the PMP provides program objectives as well as the integrated time-phased activities and resources required to do the tasks specified in the Program Management Directive (PMD). It is tailored to the needs of the particular program, reflecting the management approach most appropriate to implement the PMD and AFSC Form 56.

The PMP is composed of thirteen sections shown in Table 3-1. The amount of information included under any one section may vary considerably for each program and is determined by characteristics such as size, complexity, and planned level of forces involved.

3.2 LCC Management Considerations. Any program, unless exempted by waiver, must have LCC Management efforts documented as part of the Program Management Plan. For the most

Section	Subject	Section	Subject
1	Program Summary & Authorization	7	Operations
		8	Civil Engineering
2	Intelligence	9	Logistics
3	Program Management	10	Manpower and Organization
4	System Engineering		
5	Test and Evaluation	11	Personnel Training
6	Communications/ Electronics	12	Security
		13	Directives Application

Table 3.1 - PMP Composition

part, that document is included as part of Section 3 (Program Management) of the Plan. In many cases, however, LCC Management efforts can be documented in a referenced annex to the PMP. This annex, known as the LCC Management Plan (LCCMP), should include the same considerations required under AFR 800-11 and should provide for greater visibility of the LCC Management function. LCC Management considerations to be discussed in the plan should, as a minimum, include:

(1) The objectives of the LCC Management Program to be undertaken.

(2) The approach for establishing the LCC Management program as an integral part of the program management structure.

(3) Planned methods for addressing LCC Management and Cost considerations during Source Selection.

(4) Planned cost-related design goals to be established and the reasons for their use.

(5) Major trade studies anticipated and the methods to be used to accomplish them.

(6) Cost estimating, tracking, and reporting procedures.

(7) Planned contractual techniques to support LCC Management objectives.

(8) Specific tasking and milestones to be undertaken to establish the LCC Management program.

These items are not usually addressed separately in the LCCMP. Rather, each item is included as part of some major area, as shown in the sample Life Cycle Cost Management plan included as Appendix A to this Primer. A complete description of each item follows.

3.2.1 LCC Management Objectives. One of the best ways to establish LCC Management objectives is to gain as thorough an understanding of the program as possible. This can be done by reading and understanding the PMD, consulting knowledgeable functional experts located within the program office, and by understanding the operational requirements specified by the using command. Once an understanding is achieved, the LCC Management objectives can be developed consistent with other program objectives.

The ultimate objective of any LCC Management program should be to reduce system life cycle costs. Simply stating the primary objective, however, is insufficient when

considering the numerous disciplines that must be combined to achieve that objective. It is useful, then, to establish subordinate objectives. For instance, if it has been determined that maintenance manpower is a high cost area for the system, then stating that system life cycle cost will be controlled by limiting maintenance manpower requirements is appropriate. If on the other hand, acquisition costs are anticipated to be high, the subordinate LCC Management objective should be to control LCC by controlling acquisition costs.

3.2.2 LCC Management Approach. The LCC Management approach can best be described through the actions taken to achieve the LCC Management program objectives. The actions usually include the establishment of cost-related design goals, trade-off analyses, a cost estimating tracking and reporting system, and other managerial control devices. When discussing each of the actions, care must be taken to ensure that each is consistent with the general structure of the program. For example, describing an in-depth analysis and cost control program would be inappropriate if an experienced body of analysts is not available to the program office. More importantly, care should be taken so that actions by other functional groups is not duplicated in accomplishing LCC Management tasks.

3.2.3 LCC Management Considerations During Source Selection. Source Selection is one of the most important activities conducted during an acquisition program because it is the primary means of selecting the contractor(s) who will eventually provide the Air Force with a needed system. As such, the LCC focal point must have an approach for incorporating LCC Management and Cost considerations into the Source Selection process and eventual system development. Once developed, the approach is included as part of the LCCMP in order to provide higher level management with a description of exactly how LCC considerations will be used and evaluated during Source Selection.

LCC considerations are used during Source Selection to inform the bidding contractors exactly what the Air Force expects for the effective management of a proposed system. The contractors are informed through the discussion of LCC philosophy and requirements included in a document called the Request for Proposal (RFP). An in-depth discussion of the LCC inputs to the RFP will be provided in a later chapter. When discussing how LCC considerations will be used in Source Selection, the focal point should specifically address the Life Cycle Cost Management and estimate requirements that will be levied on the contractor. Each pertinent selection of the RFP should be addressed, with sample inputs provided, where appropriate.

LCC considerations are evaluated at Source Selection

in accordance with Evaluation Criteria specified in the RFP. In most Source Selections, LCC Management considerations are evaluated separately from LCC estimate considerations by different evaluation cadres. Usually, LCC Management is evaluated by the program LCC focal point with some assistance from the staff level (ASD/ACCL). Evaluation of the actual cost estimates, on the other hand, is usually conducted by a trained cadre of cost analysts supplied by the ASD Comptroller's Office, Air Force Logistics Command (AFLC) Headquarters, or the Air Force Air Logistics Division (AFALD) and the using command. The reason for this division of labor stems primarily from the large amount of work involved in evaluating both the LCC Management and cost proposals. More importantly, the LCC focal point does not usually have sufficient expertise to understand and evaluate the LCC estimate. The focal point should provide a description of the evaluation scheme for LCC Management considerations in the LCCMP. A discussion of the specific tasking involved in the scheme should be provided commensurate with the responsibilities of each organization involved in the evaluation process.

3.2.4 Planned Cost-Related Design Goals and Reasons for Their Use. Goals form the foundation of the planning and control functions within organizations. In recognition of this concept, the Air Force requires that goals or more specifically, cost-related design goals, become an integral

part of the program management structure. The Air Force Life Cycle Cost Management Program emphasizes the importance of goals as strategic management variables in an acquisition program. In fact, AFR 800-11 requires that cost-related design goals be established by Milestone I of the acquisition cycle and must be treated as management control devices with regular tracking and status reporting at program reviews. Further, only those programs with waivers approved by Headquarters USAF are allowed to operate without goals. It should be clear, then, that no Life Cycle Cost Management Plan is considered complete without a discussion of goals.

For the focal point, the goal development process is just as important as the end products. The process is important because it forces the focal point and program decision makers to explore significant problem areas and make carefully planned decisions in those areas. Within ASD, such program areas include system performance, cost, and technical requirements which have drawn attention because of their potential for causing significant management problems in the future. There are individuals who can help in identifying problem areas within a program. Those individuals are usually reliability and maintainability engineers, who are collocated with the program office, and staff product assurance experts. In many cases, the focal point can ally with any of these individuals to identify legitimate high cost areas.

There is no set method used in developing cost-related design goals. The goal process is truly an area where common sense prevails. Cost-related design goals are simply management objectives which are stated in terms of cost, or some parameter directly related to cost, and trackable by direct measurement or analysis. The identification of goals starts at program inception. They are established to support the overall objectives of life cycle cost reduction over predecessor systems and provide management visibility and control throughout the acquisition process.

Cost-related design goals may differ depending on the program, but in most cases, the goals should be established for:

(1) Average Unit Production Cost.

(2) Unit Operating Crew and maintenance manpower requirements.

(3) Operational reliability and maintainability parameters.

(4) Selected design controllable factors which significantly affect life cycle cost, such as average fuel consumption and mission completion success probability.

These goals are usually established from stated program requirements, LCC trade study analyses, and from analogy with existing systems.

Design to Acquisition Cost goals are established

early during the conceptual phase and are quite general at that time. In most cases, they are developed by program direction and analogy. At the early stages, the goals simply reflect affordability ceilings for system acquisition cost and are used primarily to guide study efforts. As a program progresses through subsequent phases, the top level goals are broken down into subgoals for subsystems and components representing lower levels of the System Work Breakdown Structure (WBS). These subgoals must be consistent with and lend strength to the top level goals. The goal setting process then culminates with the establishment of a design to cost goal for the average unit production cost for a specific quantity of end items.

Operating and support cost (O&S) goals, in contrast to acquisition cost goals, are established for parameters that contribute to cost savings rather than representing actual operating and support costs. Reliability and maintainability (R&M) goals make up the bulk of O&S cost goals because increased system reliability usually results in significant cost savings.

The R&M goals are established consistent with, and often the same as, those developed to fulfill the requirements of the Reliability and Maintainability Program specified in AFR 80-5. As the policy is currently written, on page 1 of AFR 80-5, the R&M program will provide for the

establishment of realistic R&M goals and objectives to be addressed as major performance parameters for each system and evaluation of each program decision milestone.

Expert judgement and analysis (remember the R&M engineers and Product Assurance experts) are used to weigh system R&M goals against other program considerations such as system performance. This decision process is driven by minimum system requirements on one end and cost savings on the other. R&M goals can be established during all acquisition phases up through the Full Scale Development (FSED) phase, but their effectiveness is increased when they are established early in the program acquisition cycle. System reliability goals usually include: system mean time to repair (MTTR), mean time between maintenance (MTBM), and mission completion success probability.

Other goals used to reduce system operating and support costs are established in a more straightforward manner. Such a goal would be that used to control system fuel consumption. The fuel consumption goal must reflect the projected system usage in gallons per hour so that it can be converted to total fuel cost. This usually includes a total flying hour program and representative missions for the aircraft system. Once the usage goal is established, it can easily be converted to a comparable cost goal by multiplying it by the approprite fuel cost factor.

The LCC focal point needs to understand that both

the issues involved in the decisions made to establish goals and the proposed goals themselves have to be discussed in the LCCMP. The focal point should also realize that the proposed goals will usually not have associated values. Those values will be required of the contractor during the Source Selection process.

3.2.5 Major Trade Studies Anticipated and the Methods to be Used to Accomplish Them. Throughout the acquisition process, and especially during the early goal development stages, program managers and engineers make decisions which will have a significant impact on system life cycle cost. To make those decisions, a great deal of pertinent information will be gathered and provided by experts in all functional areas. That information gathering process starts with the identification of cost drivers and ends with the performance of life cycle cost trade studies.

Cost drivers can encompass all program considerations from fuel consumption rates to actual system hardware. Acquisition cost drivers are identified in terms of their high acquisition cost, while Operating and Support (O&S) cost drivers are identified by their reliability, maintainability, availability, and performance criteria. For whatever category the drivers are identified, they will serve as the basis for cost-related design goals and will further serve to identify other program areas which have an adverse impact on life cycle cost.

The requirement to establish a life cycle cost trade study program originates from policy stated on page 2 of AFR 800-11. The regulation states that

> Life Cycle Cost Management efforts will stress the identification of factors which have a significant impact on life cycle cost results, and implement trade-off studies to evaluate alternative actions which could reduce the impact of such factors.

In accomplishing trade studies, the focal point must consider the constraints on the analysis. According to Blanchard, in his text Design and Manage to Life Cycle Cost, the LCC focal point must: (a) completely understand the problem area being investigated, (b) must dismiss any biases affecting the study, and (c) ensure that trade studies are accomplished in the designated time period compatible with the analysis objectives. The focal point should also understand the other external and internal constraints on the system, such as performance, operational requirements, and maintenance requirements. Once the constraints are identified, the focal point must choose the appropriate personnel to do the analyses, or determine an appropriate evaluation tool with which to conduct trade studies. Current guidance suggests that cost algorithms contained in such models as the AFLC Logistics Support Cost (LSC) Model, the Modular Life Cycle Cost Model (MLCCM), and the Cost Oriented Resources (CORE) Model are the most appropriate tools for this purpose. Information concerning these and other appropriate models

may be obtained from the ASD Life Cycle Cost MAnagement Division (ASD/ACCL).

When discussing planned trade studies in the LCC Management Plan, the focal point should provide pertinent information concerning the areas described in the above paragraphs. First, a description of the areas to be evaluated should be provided. According to Blanchard, in his previously referenced text, the list of those areas to be evaluated include:

(1) Alternative system/product operational and environmental profiles.

(2) Alternative system maintenance concepts and logistics support policies.

(3) Alternative system design configurations.

(4) Alternative procurement sources and the selection of a supplier of a given item.

(5) Alternative production approaches.

(6) Alternative product distribution channels, transportation and handling methods, and warehouse locations.

(7) Alternative logistics support plans.

(8) Alternative product disposal and recycling methods.

(9) Alternative management policies and their impact on the system.

Second, a description of the tools, techniques, and analysis

to be used to support the trade study effort should be provided. Finally, any constraint or pertinent information which has affected any trade studies already performed, or which is anticipated to affect future trade studies, should be provided in the narrative section.

3.2.6 Cost Estimating, Tracking, and Verification Procedures. An essential element in the management of an acquisition program is a system to facilitate tracking and reporting progress in meeting Life Cycle Cost Management objectives. The system resembles managerial accounting systems used in the commercial sector with the exception of the accounting practices used in each case. An Air Force tracking and reporting system provides for the on-going review, evaluation, and control of system life cycle cost. The establishment of such a system is required of both the program office and the contractor, with each having specific LCC tracking and reporting responsibilities.

A responsive contractor LCC tracking and reporting system can provide cost visibility to decision makers so that they can maintain increased control over system cost parameters and hopefully generate further analysis of cost-related design goals established early in the program. Obviously, it is appropriate for the contractor to participate in the LCC tracking and reporting system because the contractor designs the weapon system. Furthermore, the

tracking and reporting system facilitates the identification of high cost items at Source Selection. Those items can then be assessed for changes in status and subjected to an in-depth analysis in order to determine appropriate actions needed to reduce their cost impacts.

Guidance set forth in AFR 800-11 requires that program/project managers ensure that the contractor establishes and carries out an LCC tracking and reporting program. The effectiveness of such programs can usually be assessed during Program Management Reviews, Preliminary Design Reviews, Critical Design Reviews, and prior to other key program milestones. Also, during each Program Management Review, the contractor is tasked to address:

(1) Life Cycle Cost Implementation Plans and status of key activities.

(2) Cost drivers and actions being taken or planned to reduce life cycle cost.

(3) The status of cost-related design goals and variance analysis, if appropriate.

(4) Trade studies recently completed, ongoing, or planned.

(5) The life cycle cost estimate track.

To assist the contractor in establishing a Life Cycle Cost tracking and reporting system, and to ensure contractor compliance in this area, Air Force product divisions have established tasking which is included in various

contractual instruments, such as the Statement of Work. At the Aeronautical Systems Division, guidance established by the Life Cycle Cost Management Division (ASD/ACCL) has been found to be quite appropriate for assisting program offices in conveying their desire for a contractor tracking and reporting system. This contractual tasking includes requirements for the establishment of a Life Cycle Cost Management Plan, a life cycle cost estimate, hardware cost contributors, cost-related design goals, LCC assessment plans, and a design change track. Complete examples of these requirements are provided in Chapter IV of this Primer.

The LCC focal point must ensure that an LCC tracking system becomes an important part of both the contractor's management effort and the internal program management effort. To do this, the focal point must include a description of the contractor tracking and reporting requirements and a description of the internal tracking process that will take place. Internal tracking and control activities include:

(1) Preparing and documenting an annual estimate.

(2) Maintaining an estimate track, accomodating methodology changes, and assessing and tracking contractor LCC estimates.

(3) Providing estimate traceability to program changes including the impact of approved Engineering and Contract Change proposals (ECPs and CCPs).

(4) Tracking the status of cost-related design goals and actions that are initiated to overcome significant variances.

Finally, the documentation should include an identification of specific tasks, the assignment of responsibilities, and establishment of milestones which make up the total tracking and reporting system.

3.2.7 Planned Contractual Techniques to Support Life Cycle Cost Management Objectives. Various acquisition strategies are followed in bringing new systems into the Air Force inventory. These strategies and their respective phases have a great influence on the life cycle cost of a system. Although many programs follow a standard acquisition cycle which includes: Conceptual, Validation, Full Scale Development, and Production phases, there are times when modified strategies are more appropriate. Modified strategies contain differing procedures for handling successive acquisition phases and use differing levels of completion through all phases. Changes in acquisition strategies may be pre-planned or can be the result of reactions to events occurring in the program office on a daily basis. For whatever acquisition strategy is chosen, the LCC focal point will have to assess its implications and develop an LCC contracting strategy consistent with the acquisition strategy.

Life Cycle Cost contracting is a technique used to

motivate contractors to design, manufacture, and deliver the most effective life cycle cost system. It is the primary means of ensuring that the contractor implements necessary LCC Management actions. LCC contracting includes the award of a contract on the basis of lowest LCC. It also includes special contractual provisions which are oriented toward reductions in LCC.

The Defense Acquisition Regulation (DAR) recognizes lowest life cycle cost as a primary consideration for contract award. As a result, the Air Force must have a solid basis for evaluating the projected life cycle cost of a contractor's proposed system to make the award. The solid basis for the award is achieved through:

(1) The contractor's knowledge that evaluation for contract award will be on the basis of life cycle cost.

(2) The use of a government accepted Cost Element Structure (CES) and a legitimate analysis process which makes use of Air Force/Industry accepted estimating tools and methods.

(3) The use of a validated system data base for use in LCC analysis.

(4) An assessment of the contractor's management structure showing that LCC Management will be a prime program consideration.

Although these requirements will vary slightly from time to

time, they will serve as the basis for a legitimate LCC evaluation process.

The use of contract incentive devices is another method of achieving LCC objectives. Incentive provisions are popular, according to Casebere in his text A Guide to Product Assurance and Post Acceptance Contractor Liability Programs, because they serve to limit Air Force liability for substandard product quality or performance, to improve reliability on critical items, to motivate a vendor to exceed minimum acceptable requirements, or to accomplish a combination of objectives. To be effective, the extended liability program must:

(1) Cover a specific measurable period of time or number of events, such as system operating hours, operational years, and number of landings.

(2) Identify specific features, that are warranted or improved, and associated measures of performance.

(3) Be simple to administer and enforce.

(4) Be tailored to the peculiarities of the item being warranted and to the type of production contract.

(5) Be achievable by the contractor.

(6) Be obtained in a competitive environment.

(7) Contain enforceable remedies for nonperformance.

The discussion provided in the LCCMP concerning planned LCC contractual techniques should include a description of all

pertinent issues discussed in this section. However, attention should be focused on the contract incentive provisions which are planned for the system and the reasons for their use.

There are many types of incentives used to achieve the extended liability of the contractor. Complete descriptions of each type would be too lengthy to include in this Primer. A very useful document which provides state-of-the-art information on contract incentive provisions is the Product Performance Agreement Guide. This guide, available through ASD/ACCL, is one of the best single sources of incentive information available at ASD.

3.2.8 LCC Management Tasks and Responsibilities. When describing the managerial responsibilities for the LCC Management program, attention should be focused on exactly who is responsible for the program and how the individual in charge of the program will act to integrate LCC Management considerations into the program management structure. AFR 800-11 stipulates that the program manager (PM) is ultimately responsible for the LCC Management program. In most cases however, the authority for conducting the program is delegated to an LCC manager/focal point. The name and title of that LCC manager should be provided in the plan.

Having provided the background information concerning who is in control, the next task is to describe how the

LCC Management control will be achieved by the program office, through the LCC manager, and by the contractor. This description of the specific responsibilities should include all tasks to be carried out by the program office, in conjunction with the using command and the contractor.

3.3 Sample Life Cycle Cost Management Plan (LCCMP). A sample LCCMP is provided as Appendix A to this Primer to provide guidance for developing LCC Management Plans. The sample represents an actual plan already developed for the M-X missile program. It contains information pertinent to all LCC Management concerns and, more importantly, is organized according to the information provided in Section 2 of this chapter. As a result, this sample should provide excellent guidance for the development of future LCCMPs.

4.0 LCC MANAGEMENT INPUTS TO THE REQUEST FOR PROPOSAL.

4.1 General. The Request for Proposal (RFP) is an extension of the acquisition strategy provided in the Acquisition Plan. It is used as the primary means of soliciting industry's proposals for a major weapon system. The RFP also enhances communication between the government and the contractor which facilitates an understanding of a particular program. The document is composed of thirteen sections, labeled A through M, and attachments. Each of the thirteen sections contains specific language for program requirements such as cost, performance, and schedule. More importantly, the RFP provides specific instructions on how to meet those requirements both at Source Selection and during the period of contract.

4.2 LCC Management Considerations. From a Life Cycle Cost Management standpoint, the RFP performs three very useful functions. First, it provides the contractor with information concerning the relative importance that the government is placing on the LCC Management program for a particular system. Second, it is the primary tool used to obtain information needed to: (a) determine the best source for providing a life cycle cost effective system, and (b) establish the LCC Management Program to be undertaken as part of the

contract. Finally, it establishes the foundation for an LCC Management partnership between the government and contractor. The LCC Management inputs included in various sections of the RFP must be tailored to perform at least those three functions.

The requirements and instructions provided in various sections of the RFP are, in most cases, developed by a heterogeneous group of staff and program office functional experts. The LCC focal point, as the LCC expert, must also provide inputs to certain sections in order that the needs of the LCC Management Program are understood and realized by the contractor. Although the LCC Management philosophy is a systems philosophy, it would be unrealistic to include LCC inputs in each section of the RFP. However, the focal point must ensure that LCC Management inputs are at least consistent with, and lend strength to, other program requirements such as those found in the system specification.

LCC Management inputs should be provided for each of the following sections of the RFP:

(1) Evaluation Factors for Award

(2) Instructions to Offerors

(3) Statement of Work

(4) Contract Data Requirements Listing (CDRL) and Data Item Description (DID).

A complete discussion of the LCC inputs used in each of these sections is provided in the paragraphs that follow.

4.2.1 Inputs to the Evaluation Factors for Award. The LCC considerations included as part of the Evaluation Factors for Award (Section M) of the RFP are very important to the establishment of a legitimate LCC Management program. They are important because the evaluation factors specified in this section are the primary parameters used by the contractor to structure a program. As such, the words used to describe how the contractor's proposal will be evaluated can force the contractor to concentrate efforts in certain areas. When structuring the inputs for this section, the focal point should thus accentuate those areas considered most important to the development of the LCC Management program.

The Evaluation Factors for Award Section usually includes a description of the actual parameters to be used in the evaluation (Basis for Award) and specific information concerning how each parameter or area will be evaluated (Scope of the Evaluation). The focal point usually has little control over the factors that serve as the Basis for Award. That control is normally exercised by the program manager and the Source Selection authority.

When considered, system Life Cycle Cost/LCC Management may be included as one of the ranked factors, or may be included as part of other factors, such as Cost or Management. When ranked separately, life cycle cost is usually evaluated as a cost consideration. In this case, the

discussion of LCC included in the Scope of the Evaluation should provide information concerning how the life cycle cost estimate will be evaluated. The focal point will not be directly involved in the validation process in most cases, but is responsible for ensuring that the evaluation process is described in Section M. An example input of LCC as a ranked cost factor is provided below.

SECTION M

Evaluation Factors for Award

2. Basis for Award. The Source Selection Authority (SSA) will select the contractor for the NGT system based on an assessment of proposals submitted in response to the NGT Request for Proposal, and on the terms and conditions agreed upon during negotiations. While this assessment will strive to determine the overall value of each system, the government will also evaluate each offeror's willingness to incorporate unique features or system enhancements deemed beneficial to the government. The government reserves the right to award a contract at other than lowest proposed life cycle cost. Throughout the assessment and evaluation, the order of importance of major evaluation areas listed below will be observed:

a. Operational Utility

b. Life Cycle Cost

c. Design Approach

d. Program Adequacy

3. Scope of Evaluation.

b. Life Cycle Cost. A Basis for Award will be the government's estimate of the most probable cost to develop, acquire, and support the operation of the proposed system over a 20-year period. The Operating and Support (O&S) costs will be based upon a force

derived from the mission profiles. The RFP will provide a FYDP funding profile. The contractor's ability to provide a system which meets the specifications within the funding profile will be evaluated, but the contractor will be encouraged to provide funding excursions which will also be assessed. The RFP will provide a basis for the offeror to provide a unit price matrix for his program; the unit price matrix will be used to determine the acquisition cost of the program. The Life Cycle Cost assessment will consider:

(1) Full Scale Development

(2) Weapon System Cost

(3) O&S Cost

(4) Other Support Cost

(5) Realism, Reasonableness, and Completeness

Only the ranking is provided in paragraph 2, "Basis for Award." A description of how the life cycle cost estimate will be evaluated is included in paragraph 3, Section M, "Scope of the Evaluation." The reader will notice that the evaluation ground rules provide specific contractor responsibilities, such as the funding profile which is to be included in the RFP.

The LCC focal point is also responsible for ensuring that LCC considerations are included as part of the Management evaluation, if Management is ranked as an evaluation factor. To ensure that LCC is considered, the "Scope of the Evaluation" must describe exactly how the contractor's LCC Management approach will be evaluated. The discussion should serve to inform the contractor that the Air Force is placing emphasis on the contractor's ability to manage system LCC.

Specifically, the discussion should state that the contractor's LCC Management approach will be evaluated in context with the total management and design efforts being conducted for the system. An example input of LCC considerations included as part of the management evaluation is provided below:

SECTION M

Evaluation Factors for Award

Source Selection Evaluation Criteria

3. Scope of Evaluation.

c. Management Area. Each offeror shall submit a Management Proposal which will be evaluated for strengths, weaknesses, and risks based upon the following criteria

(x) Life Cycle Cost Management. The offeror's overall Life Cycle Cost (LCC) management approach will be evaluated to determine the extent to which LCC considerations are a part of the proposed management and design efforts. The approach for integrating LCC considerations into the overall program management, design and preproduction efforts will be evaluated for realism and adequacy. Proposed implementation actions and activities will be assessed for reasonableness and completeness. The offeror's LCC management plan will be reviewed to determine the depth of understanding of organizational responsibilities and interrelationships and to ensure all Statement of Work LCC Management requirements have been adequately addressed.

The reader should take note of the information in the Life Cycle Cost Management paragraph above. It should become clear in later sections of this chapter that the information contained in this paragraph is quite consistent with the requirements levied on the contractor in the Instructions to

Offerors and Statement of Work.

It should also be noted that by preparing inputs to the Evaluation Factors for Award Section, the focal point will have served two purposes since the inputs to Section M can also be used as the Life Cycle Cost and Life Cycle Cost Management inputs to the Source Selection Plan. In fact, the structure for the inputs to the Evaluation Factors section is nearly identical to that found in the RFP.

4.2.2 Inputs to the Instructions to Offerors (ITO). The Instructions to Offerors (ITO), Section L, of the RFP contains information which specifies exactly what each bidder is required to furnish the Air Force for Source Selection. The ITO is, in essence, a snapshot or premonition of what the Air Force can expect under contract. It is used by the Air Force to choose the best bidder. As such, the information and requirements included in the ITO should be specific, to the point, and consistent with the contractual requirements included in the Statement of Work (SOW), Evaluation Factors for Award, and Contract Data Requirements sections.

The ITO is composed of five sections: Technical, Operational Utility, Cost to the Government, Management Approach, and Integrated Logistics Support. LCC should be considered in each of these areas. However, major LCC inputs are usually only included in the Cost to the Government and Management Approaches sections. The LCC inputs to each of

of those sections are addressed next.

Inputs to the Management section of the ITO should be consistent with the LCC Management program described in the PMP and the contractual requirements specified in the SOW. In many cases, the requirements levied on the contractor in the Management section of the ITO are directly related to the Statement of Work, as shown in the sample below.

> X.XX.X Life Cycle Cost Management. The offeror shall discuss the approach for integrating life cycle cost considerations into his overall program management, design, and production efforts. The discussion should provide the government with complete and concise information on the offeror's understanding of life cycle cost management and the specific implementation actions and activities (including milestones) to be undertaken as part of the development and production efforts. The offeror should address both internal contractor LCC management efforts and government interface/ reporting efforts. The offerors shall specifically address the approach for satisfying the requirements of FSED Statement of Work paragraph 1062C.04.

A paragraph of this type is included as a numbered paragraph in the Management Approach section. The paragraph presents an outline of the information from the contractor which is necessary to illustrate whether or not the contract LCC Management efforts are consistent with the LCC Management Program described in the LCCMP. The sample shown above represents the type of inputs used in a major program. Many

programs, however, will not accomodate such inputs because of different programmatic issues. In cases where the general sample will not work, the focal point will need to tailor an input appropriate for the program. Two examples of such tailored inputs are provided below.

> 3.8 Life Cycle Cost (LCC) Management. The offeror shall discuss the approach for integrating life cycle cost considerations into the offeror's overall program management, design, and preproduction efforts. The discussion shall provide the Government with complete and concise information on the offeror's specific implementation actions and activities to be undertaken as part of the development and preproduction efforts.

> 3.8 Life Cycle Cost (LCC) Management. The offeror shall discuss the approach for integrating life cycle cost considerations into the offeror's overall program management, design, and preproduction efforts. The discussion shall provide the Government with complete and concise information on the offeror's specific implementation actions and activities to be undertaken as part of the development and preproduction efforts.

The focal point should notice that although these two inputs have been significantly tailored, they nonetheless contain the thrust of the larger generic input. This should indicate to the reader that the program need not be a major one in order that LCC Management be considered part of the Source Selection process.

The LCC inputs to the "Cost to the Government" section, on the other hand, are usually tailored to cost

estimating requirements. In most cases, the LCC inputs will pick up where other cost requirements leave off. Specifically, those categories of cost not considered as part of development or production costs are included in this section. Although the focal point may not be directly involved in the O&S estimate validation process, the information provided will be used in future applications, such as cost tracking and control. It is to the focal point's advantage, then, that the cost information be requested from and provided by the contractor.

The inputs require the contractor to provide specific cost information. That cost information will be used by the O&S Cost panel to validate the O&S cost estimate during Source Selection. The requirement has evolved from the increased emphasis on life cycle cost. The information obtained through the Cost section facilitates the estimating process and adds credibility to the LCC estimate.

In addition to the requirements for cost information, there is also a requirement for the contractor to provide a list of preliminary cost-related design goals. As described in an earlier chapter, cost-related design goals perform the very useful function of guiding a program to specific end results in areas such as performance and cost. It is reasonable, then, to assume that proposed goals are very important when trying to determine the contractor best suited for the job of building a particular system. Thus, the requirement

for preliminary cost goals is levied on the contractor in order that goals become a decision variable in the Source Selection process.

Samples of all of the requirements just discussed are provided below. The first sample is a generic input used primarily for major systems. It requires the contractor to submit estimates for specific categories of cost. Further, the ground rules and assumptions for development of specific data estimates are to be provided in order to facilitate any estimate validation which will take place. Preliminary cost-related design goals have been required for each of the parameters discussed earlier in Chapter 3, such as crew size, average flyaway cost, and full mission capable rate.

6. Initial Support Cost Estimates. The contractor will provide the Initial Support Investment Costs for:

a. Training Equipment Cost

b. Common Support Equipment Cost

c. Peculiar Support Equipment Cost

d. Initial Spares Cost

These will be provided in accordance with the cost estimating ground rules included in Annex 3 of the FSD Statement of Work.

7. Operating and Support Cost Estimates. A 25 year O&S cost estimate including phase-in expressed in US Government FY81 dollars will be provided using the annual O&S cost model included in Annex 4 of the Air

Vehicle FSD Statement of Work. The estimate documentation shall include:

a. Ground Rules and Assumptions

b. Estimate Results

c. All Model Input Data

d. Supporting Data Including:

1. A listing of comparable equipments in use for a similar purpose of existing government or commercial aircraft. Commercial maintenance data shall be provided if comparable commercial aircraft usage is identified.

2. Adjustment factors of maintenance rates which will be applied to field data to adjust differences between the new and comparable equipment.

3. A narrative discussion on the rationale used to select the comparable equipment and the adjustment factor.

4. Recommendations for improved maintenance operating procedures to reduce total maintenance manpower.

5. A preliminary WUC listing, identifying all major line replaceable units (LRUs) of the air vehicle.

8. System Cost-Related Design Goals. The contractor shall establish and provide system cost-related design goals for:

a. Average Unit Flyaway Cost in FY81 dollars (nonrecurring and recurring costs) for a production quantity of ____ aircraft at a production rate of ____ per month.

b. Crew Size

c. Maintenance Manhours per Flying Hour

d. Full Mission Capable Rate

e. Fuel Consumption (Gals/Hr.)

f. Mean Time Between Maintenance Activity

Along with the goal values, the contractor shall provide the specific definitions for the goals, and the rationale and data used in developing those goals. Complete goal definitions and goal values shall be incorporated into the FSED Statement of Work (SOW) paragraph 1062F. The offeror will provide the potential cost impacts of the ten most life cycle cost influential contract requirements provided in accordance with Section L, Volume IV, paragraph 4.7.

In most cases when systems other than a complete aircraft are being procured, there are modified inputs used to attain the cost data needed in Source Selection. For example, in those cases when an engine is procured, the same inputs shown above will suffice with modifications to the system cost-related design goals. The key in an engine program application is to treat the engine as a separate major system and adjust the generic input accordingly. For other less than major systems, such as radios, towbars, and radars, tailored inputs such as those illustrated below are more appropriate.

5.1.7 Life Cycle Cost (LCC) Requirements. The contractor shall develop and provide a rank-ordered list of the five components on each class of towbar (Class I and Class II) which have the greatest potential impact on life cycle cost. The contractor shall provide a unit Design to Cost goal in FY81 dollars, for a production quantity of 300 Class I towbars and 100 Class II towbars. This goal will be based on the methodology provided in paragraph B of Annex ____ to this RFP. The contractor shall also provide, for each class of towbar (Class I and Class II), a separate baseline LCC estimate. The estimate shall be expressed in FY81 dollars and shall reflect the total

development, production and 15 year operating and support costs for each class of the Universal Aircraft Towbar. These two Universal Aircraft Towbar LCC estimates shall be computed using the methodology contained in Annex ___ to this SOW and shall include all data and supporting rationale needed to compute and evaluate the estimate.

X.X.X Operating and Support Cost Estimates

A 20 year O&S cost estimate, expressed in U. S. Government FY dollars will be provided using the Cost Oriented Resource Model (CORE) as documented in AFR 173-13. The estimate documentation shall include:

a. The data and sources of data on which the estimate is based.

b. The estimating methods applied to that data including a description, as complete as possible, of parametric equations, factor derivations, or build-up techniques for each part of the estimate.

c. The results of the analysis including ground rules and assumptions.

These sample inputs were actually used for the Universal Aircraft Towbar (UAT) and the Long Range Cruise Missile Carrier Aircraft (LRCA). Although tailored, these sections still require basic information from the contractor such as a cost estimate, the supporting data, and the rationale used in making that estimate. For the towbar, a single Design to Cost Goal was appropriate because the towbar was a mechancally simple item. For the LRCA, DTC goals were eliminated from consideration because the LRCA was considered to be a derivative of the previously designed B-1 bomber.

4.2.3 Inputs to the Statement of Work (SOW). The Statement of Work is that part of the RFP which eventually becomes the contract. The SOW specifies the work tasks to be accomplished by the contractor under the terms of the contract for the entire contract period. It is crucial, then, that LCC inputs be included in the SOW so that LCC Management becomes an integral part of the contractor's management structure. In addition, the LCC inputs included in the SOW are the primary means of ensuring consistent government and contractor Life Cycle Cost Management programs.

The LCC inputs to the SOW are easily generated because they are primarily an extension of the LCC Management tasks and responsibilities described in the LCCMP. Depending on the LCC Management program being undertaken, the inputs can be as extensive as those shown in samples 1 and 2 below, or as simple as those shown in sample 3.

Samples 1 and 2 were actually used for ASD programs--with sample 1 being the input to an aircraft system contract and sample 2 being the input used for a separate engine contract. The reader will notice that the structure of the two samples is the same because both the aircraft and the engine were treated as major systems. The inputs outline the tasks to be conducted during the contract such as the establishment of an LCC estimate, cost-related design goals, trade studies, and an LCC tracking system. The focal point should recognize at this point that these are the same parameters discussed in the LCCMP.

Sample 1

1062C.04 Life Cycle Cost Management. The contractor shall implement a Life Cycle Cost Management Program which makes the consideration of life cycle cost an integral part of the contractor's management and design efforts.

1062C.04.01 The contractor shall develop and implement an LCC Management Plan covering all program phases and addressing the following as a minimum: (DI-F-30203)

a. Statement of LCC management objectives and description of supporting tasks, milestones, and responsibilities.

b. Program management structure, policies and procedures, and functional interrelationships for maintaining LCC visibility and control.

c. Methods for determining and identifying LCC drivers and issues subject to trade-off analysis.

d. Preliminary list of the ten most life cycle cost influential contractual requirements (e.g., performance, schedule, standards, specifications).

e. Identification/description of planned analysis methods and techniques to be utilized in LCC analyses.

f. Management and methodology for integrating subcontractor efforts into LCC management efforts.

g. Recommended cost-related design goals and planned allocation procedures.

h. Planned feedback mechanism for tracking and reporting cost-related design goals and status. Include proposed analysis and test and evaluation efforts to be used as progress checks.

1062C.04.02 The contractor shall prepare and document a baseline LCC estimate which reflects the selected hardware configuration and support concept. The estimate will be expressed in constant FY 81 dollars and reflect time phased development, production, and 20 year Operating and Support (O&S) costs. The O&S estimates will be accomplished using the

Cost Oriented Resource Estimating (CORE) Model as documented in AFR 173-13. The Operating & Support costs estimates shall contain the supporting rationale for the input data, including a hardware/work task list for the system. Along with this the contractor will provide the baseline military or commercial data for each hardware/work task element and the rationale for differences.

1062C.04.03 The contractor shall perform LCC trade studies on LCC drivers and issues identified in the contractor's LCC Management Plan. Additional trade studies shall be performed as additional LCC issues or cost reduction opportunities are identified. LCC trade studies will be performed as a minimum to document:

a. Selection of the hardware and support system design approach.

b. LCC sensitivities to performance requirements.

c. Choice of cost-related design goals (e.g., operational availability, reliability, and maintainability parameters).

d. Design trade-offs which significantly impact LCC results.

e. Choice of maintenance and support concepts.

1062C.04.04 As a minimum, the contractor shall establish cost-related design goals for:

a. Average Unit Flyaway Cost in FY 81 dollars (non-recurring and recurring costs) for a production quantity of ____ aircraft at a production rate of ____ per month.

b. Mission Completion Success Probability.

c. Maintenance Manhours per Flying Hour.

d. Sortie Generation Rate.

e. Full Mission Capable Rate.

f. Fuel Consumption (Gals/Hr.).

The contractor shall insure consistency between the cost-related design goals for reliability and

maintainability parameters and the Reliability and Maintainability Program and the Integrated Logistics Support Program.

1062C.04.05 The contractor shall develop a list of items/equipment (normally line replaceable units (LRU)) including software support equipment from his proposed design which are potential LCC drivers. This rank ordered list shall represent those system components which account for not less than 80% of total estimated LCC. Following review of this list, the Air Force will identify a maximum of 25 items/equipments for which the contractor shall identify optional approaches. Recommended alternatives shall address potential LCC savings and the impact on performance and mission capability. For each approved alternative, the contractor shall prepare and implement an LCC assessment plan. The LCC assessment plan shall describe progress checks and/or test and evaluation activities to be used to assess achievement of the objectives.

1062C.04.06 The contractor shall make LCC a major consideration in the selection and management of subcontractors. The contractor shall insure that LCC management efforts applicable to this contract are passed down to the subcontract level.

1062C.04.07 The contractor shall prepare an LCC impact assessment on all contractor change proposals (CCP) and engineering change proposals (ECP).

1062C.04.08 The contractor shall maintain an assessment, tracking, and reporting system for the LCC Management Program.

1062C.04.09 The contractor shall provide for periodic (formal/informal) Government reviews in support of Air Force program validation milestones (e.g., Preliminary Design Reviews and Critical Design Reviews) and program management reviews. Each review shall address the current LCC estimate and estimate track to the baseline estimate; the program cost drivers (e.g., specific configuration items, performance characteristics, or program requirements) and actions recommended or taken to reduce or control costs; the status of each cost-related design goal; a review of design changes incorporated since the previous review and their impact on the LCC estimate and each cost-related design goal; and a listing of potential design changes under consideration and their estimated impact on the LCC estimate and each cost-related design goal.

Sample 2

2062.03.04 Life Cycle Cost Mangement. The contractor shall implement a Life Cycle Cost Management Program which requires that life cycle cost is an integral part of the contractor's management and design efforts. (Reference AFR 800-11, AFSC/AFLC Sup 1 and SD Sup 1 thereto, and AFSCP/AFLCP 800-19.)

2062.03.05 LCC Management Plan. The contractor shall develop and implement an LCC Management Plan covering all program phases and addressing the following as a minimum: (DI-F-30203/M)

a. Statement of LCC management objectives and description of supporting tasks, milestones, and responsibilities.

b. Program management structure, policies and procedures, and functional interrelationships for maintaining LCC visibility control.

c. Methods for determining and identifying LCC drivers and issues subject to trade-off analysis and preliminary list of drivers and issues planned for trade-off analysis.

d. Preliminary list of the ten most life cycle cost influential contractual requirements (e.g., performance, schedule, standards, specifications).

e. Identification/description of planned analysis method and techniques to be utilized in LCC analyses. This shall include detailed descriptions of estimating model, associated costing ground rules and assumptions, detailed description of approach to sensitivity analysis inputs, analysis outputs, and data sources.

f. Management and methodology for integrating subcontractor efforts into LCC management efforts.

g. Establishment and allocation of cost-related design goals.

h. Planned feedback mechanism for tracking and reporting cost-related design goals and status. Include proposed analysis and test evaluation efforts to be used as progress checks.

2062.03.06 LCC Estimate. The contractor shall prepare and document a baseline LCC estimate which reflects the selected hardware configuration and support concept. The estimate will be expressed in constant FY81 dollars and reflect time phase development, production, and 20 years Operating and Support (O&S) costs. Acquisition and O&S estimates will be accomplished using a 3 level maintenance concept.

2062.03.07 LCC Trade Studies. The contractor shall perform LCC trade studies on LCC drivers and issues identified in the contractor's LCC Management Plan. Additional trade studies shall be performed as additional LCC issues or cost reduction opportunities are identified. LCC trade studies will be performed as a minimum to document:

a. Selection of the hardware and support system design approach.

b. LCC sensitivities to performance requirements.

c. Choice of cost-related design goals (e.g., operational availability, reliability, maintainability, and producibility parameters).

d. Design trade-offs which significantly impact LCC results.

e. Choice of maintenance and support concepts.

Trade study cost documentation shall include supporting input data and rationale used to derive the development, production, and operation and support cost estimate.

2062.03.08 Cost-Related Design Goals. The contractor shall establish cost-related design goals for the engine, modules/major assemblies, and control/accessories, which shall consist of:

a. Unit production cost in FY81 dollars.

b. Engine Shop visit rate per 1000 EFH (scheduled and unscheduled separately identified).

c. Line repairable unit shop visit rate per 1000 EFH.

d. Maintenance manhours per EFH (organization, intermediate, and depot separately).

e. Parts consumption cost per EFH (including condemnation spares).

f. Meantime between maintenance actions (for the engine, each LRU, and each first indenture (SRU)).

g. Fuel consumption benchmark.

h. MMH/Engine Maintenance Action.

i. Engine and LRU Not Repairable This Section (NRTS) rates.

The contractor shall insure consistency between the cost-related design goals for reliability and maintainability parameters, the Reliability and Maintainability Program, and the Integrated Logistics Support Program.

2062.03.09 LCC Drivers. The contractor shall develop a list of items/equipment (normally line replaceable units (LRU)) including if applicable software support equipment for his proposed design which are potential LCC drivers. This rank ordered list shall represent those system components which account for not less than 80 percent of total estimated LCC. Following Air Force review and approval of this list, the Contractor shall identify alternative approaches. These alternatives approaches shall be identified not later than 30 days prior to CDR. Recommended alternatives shall address potential LCC savings and the impact on performance and mission capability. For each approved alternative the contractor shall prepare an LCC assessment plan. The LCC assessment plan shall describe progress checks and/or test and evaluation activities to be used to assess achievement of the objectives.

2062.03.10 Management of Subcontractors. The contractor shall insure that LCC management efforts applicable to this contract are passed down to the subcontract level.

2062.03.11 Change Proposals. The contractor shall prepare an LCC impact assessment on all contract change proposals (CCP) and engineering change proposals (ECP). The assessment shall address each element of cost impacted, the potential magnitude of the impact, and the rationale for the impact along with traceability to the baseline estimate, previous estimate, and each cost-related design goal.

2062.03.12 Assessment, Tracking, and Reporting. The contractor shall maintain an assessment, tracking, and reporting system for the LCC Management Program.

2062.03.13 Periodic Reviews. The contractor shall provide for periodic (formal/informal) Government reviews in support of Air Force program validation milestones (e.g., Preliminary Design Reviews and Critical Design Reviews) and program management reviews. Each review shall address the current LCC estimate and estimate track to the baseline estimate; the program cost drivers (e.g., specific configuration items, performance characteristics, or program requirements . . .

For smaller programs such as the Universal Aircraft Towbar (UAT), the need for extensive LCC Management sections in the SOW does not exist. In those cases, tailored LCC Management sections are adequate to define the exact needs of the LCC Management Program. Notice that the Towbar LCC Management section input, provided as sample 3 below, contains requirements very similar to those included in samples 1 and 2, except for the degree in which the requirements are levied. For instance, there is only one goal, a Design to Cost Goal; and the LCC Management, Estimate, and Tracking and Reporting requirements are less stringent.

Sample 3

7.1.2.2. Life Cycle Cost (LCC) Management. The contractor shall implement a Life Cycle Cost Management Program which makes the consideration of LCC an integral part of the contractor's management and design efforts. Emphasis in the Universal Aircraft Towbar development and preproduction efforts shall be on designing Class I and Class II towbars with the lowest life cycle

costs, that meet or exceed the minimum acceptable requirements. Based on historical data, it has been established that the running gear, flanges, and attachment head have the greatest negative impact on the current towbar life cycle cost. The contractor shall specifically address these areas and shall describe his method for correcting the potential adverse impacts of these areas on the Universal Aircraft Towbar life cycle cost.

7.1.2.2.1. Design to Cost (DTC) Goal. The contractor shall estimate a system level Design to Cost goal. This goal will reflect the average unit production cost for the Universal Aircraft Towbar based on a production quantity of 300 Class I bowbars and 100 Class II towbars. The DTC goal will be computed using the methodology contained in paragraph 2 of Annex ___ to this SOW. The contractor shall insure consistency between the Design to Cost goal and the reliability, maintainability, and availability requirements of the Universal Aircraft Towbar.

7.1.2.2.2. Baseline LCC Estimate. The contractor shall prepare and document a baseline life cycle cost estimate for each class of the Universal Aircraft Towbar. Each estimate shall reflect the selected hardware configuration, support concept, and operational criteria for the Universal Aircraft Towbar. The estimate will be expressed in constant FY81 dollars and shall reflect the development, production, and 15 year operating and support costs of the Class I and Class II towbars. Both the Class I and Class II baseline estimates shall be computed using methodology contained in Annex ___ to this SOW. All subsequent estimates shall track to the baseline LCC estimate established during source selection and to the previous estimate.

7.1.2.2.3. LCC Assessment, Tracking, and Reporting System. The contractor shall provide for periodic (formal, informal) Government reviews in support Air Force program validation, milestones (e.g., Preliminary Design Reviews and Critical Design Reviews) and program management reviews. Each review shall address the current LCC estimate and track to the baseline LCC estimate. The contractor shall provide an update on the DTC goal at each review and shall report the status of the high cost driver areas and actions taken to alleviate the potential adverse impact of these areas on the towbar LCC.

4.2.4 LCC Data Requirements. The reader has undoubtedly noticed the continued reference to DI-F-30203 in the sample RFP inputs already provided. DI-F-30203, the LCC data item, is a final and very important part of the LCC inputs to the RFP. The LCC data item, and concurrent Contract Data Requirements List (CDRL), specify to the contractor exactly what LCC data and information is to be provided during the period of the contract and when that data and information is to be provided.

The specific data and information requirements are included in the LCC data item of which there are currently two accepted forms. They are the DI-F-30202 for all applications except engine contracts which use a modified LCC data item, DI-F-30203/M. Each of the data items specifies the cost data and LCC management information required in the Statement of Work. As shown in the samples provided in Appendices B-1 and B-2, the data and information requirements are divided into three parts, each representing a requirement levied on the contractor in the Statement of Work (SOW). The three parts are:

1. Part I--Design to Cost/Life Cycle Cost Plan
2. Part II--Cost Data
3. Part III---Engineering Trade Studies Report

The focal point should recognize that each part is simply a reiteration of the requirements already included in the LCC Management section of the SOW. This consistency is

established since the Data Item formalizes the requirements of the SOW.

The Contract Data Requirements List includes information that specifies exactly when the cost data and other information provided by the contractor is to be delivered. The standard form contains sixteen numbered blocks which include information needed by the contractor in meeting the data requirements. The focal point concentrates attention on block 16, "Remarks," as blocks 1 through 15 can be easily filled in with the assistance of the data manager. Samples of two CDRLs, which are consistent with the data items already discussed, are provided below. The focal point should notice the block 16 requirements. The submittal time for each data item part is stated, as is the submittal time for specific portions of each part, when appropriate.

In many cases, the consistency between the LCC Management inputs to the SOW and DI-F-30203 or DI-F-30203/M is difficult to achieve because of the limited scope of a program; for example, a less than major system. In those cases, the data item is modified to be consistent with the tailored Statement of Work of the smaller system. That modification to the data item is most easily achieved in the CDRL block 16 as shown in the first CDRL sample, block 16, point 7. In fact, clarifications or deletions to the data item can be made to suit the scope of the program.

Inputs for DI-F-30203

CONTRACT DATA REQUIREMENTS LIST

ATCH NR ____ SYSTEM/ITEM ____

TO CONTRACT/PR F33657-81-0395A CATEGORY ____ CONTRACTOR ____

1. Sequence Number	2. Title or Description of Data / 3. Subtitle	4. Authority (Data Item Number)	5. Contract Reference	6. Technical Office	7.	8.	9.	10. Frequency	11. As of Date	12. Date of 1st Submission	13. Date of Subsequent Submission/Event ID
1037	Design to Cost/Life Cycle Cost Document	DI-F-30203	FSD SOW Paras 1062F1 thru F8	ASD/AFPA	Lt	A		Blk 16	N/A	See Blk 16	See Blk 16

14. Distribution and Addresses (Addressee—Regular Copies/Repro Copies)

Addressee	Copies
ASD/AFPA	2/0 A
ASD/AFCG	1/0 A
ASD/AFGM	1/0 A
ASD/AFGML	1/0 A
ASD/AFG	1/0 A
ASD/AFGE	1/0 A
AFPRO/ACO	1/0 J
15. TOTAL	8/0

16. REMARKS

Blocks 10, 12 & 13:

1. Submit Part I (LCC Mgt Plan) updates thru FSD Phase of program on as-required basis.

2. Submit Part II (Cost Data) annually, 10 days prior to NGT PDR, 10 days prior to NAG CDR, and NLT 30 days after DSARC III.

3. Submit Rank Ordered List quarterly.

4. Submit Cost-Related Design Goal Status 30 DAC and monthly thereafter.

5. Submit Part III (Engineering Trade Study Report) NLT 30 DAC and as individual studies are completed.

6. If notification of Government approval is not received within 30 work days after each submittal, the contractor shall consider the reports to be approved. When required revised reports shall be submitted 30 days after receipt of Government disapproval.

7. Ref Blk 41: DI-F-30203 is modified as follows:
Add to cost data report outline (Part II)
- LCC estimate tracks
  -- baseline estimate to current estimate
  -- previous estimate to current estimate
  -- variance analysis
  -- CCP/ECP estimate impact tract
- Cost-Related Design Goal Status
  -- goals
  -- current estimates
  -- variance analysis
  -- corrective action planned

PREPARED BY ____ DATE ____ APPROVED BY ____ DATE ____

DD FORM 1 JAN 70 1423 (A)

PAGE ____ OF ____ PAGES

Inputs for DI-F-30203/M

CONTRACT DATA REQUIREMENTS LIST

ATCH NR 2

TO CONTRACT/PR F33657-81-C-0395C

CATEGORY FINANCIAL

SYSTEM/ITEM NGT FSED

CONTRACTOR

1. Sequence Number	2. Title or Description of Data / 3. Subtitle	4. Authority (Data Item Number)	5. Contract Reference	6. Technical Office	7. DD 250 Req	8. App Code	9. Input to IAC	10. Frequency	11. As of Date	12. Date of 1st Submission	13. Date of Subsequent Submission/Event ID	14. Distribution and Addressees	Copies
2039	Design-to-Cost/Life Cycle Cost Document	DI-F-30203/M (Attached)	SOW 2062.03.05	ASD/YZP	Lt	N		See Blk 16	See Blk 16	See Blk 16	See Blk 16	ASD/YZP	1/0
												ASD/YZPI	1/0
												ASD/YZPR	1/0
												ASD/YZLR	1/0
												SEE BLK 16	
												15. TOTAL	4/0

16. REMARKS

1. Block 4 - Contractor format is acceptable as long as the information required by the standard format is provided. See Addendum 1 in Back-up Material for DI-F-30203/M.

2. Blocks 10, 11, 12 & 13 - The contractor shall submit Part I and initial Part II as part of the FSED contract. Subsequent Parts II and III shall be updated quarterly and submitted within 15 calendar days after contract award.

3. Part I (a) goals for engine, module/major assemblies, and controls/accessories shall consist, as a minimum, of:

a. Engine shop visit rate, per 1000 EFH (scheduled and unscheduled separately identified).

b. Line repairable unit rate, shop visit per 1000 EFH.

c. Maintenance manhours, per EFH (organization, intermediate, and depot separately).

d. Parts consumption cost, per EFH (including condemnation spares).

e. Mean time between maintenance actions (for the engine, each LRU, and each first indenture SRU).

f. Fuel consumption benchmark.

g. Unit Production Cost in FY81 dollars.

PREPARED BY	DATE	APPROVED BY	DATE

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CONTRACT DATA REQUIREMENTS LIST

ATCH NR 2

TO CONTRACT/PR F33657-81-C-0395C

CATEGORY FINANCIAL

SYSTEM/ITEM NGT FSED

CONTRACTOR

1. SEQUENCE NUMBER	2. TITLE OR DESCRIPTION OF DATA 3. SUBTITLE	4. TECHNICAL OFFICE	10. FREQUENCY	12. DATE OF 1ST SUBMISSION	14. DISTRIBUTION AND ADDRESSES (Addressee—Regular Copies/Reapro Copies)
5. AUTHORITY (Data Item Number)	6. CONTRACT REFERENCE	7. [illegible] CODE (a)	11. AS OF DATE	13. DATE OF SUBSEQUENT SUBM/EVENT ID	15.
1. 2039	2. Design-to-Cost/Life Cycle Cost Document 3.	4. ASD/YZP	10. See Blk 16	12. See Blk 16	15.
5. DI-F-30203/M (Attached)	6. SOW 2062.03.05	7. Lt 8. N 9.	11. See Blk 16	13. See Blk 16	15.

16. REMARKS

h. MMH/Engine Maintenance Action.

i. Engine and LRU Not Repairable This Station (NRTS) rate.

The contractor shall insure consistency between cost-related design goals for reliability and maintainability parameters and the Reliability and Maintainability Program and ILS Program.

4. Block 14--Letters of Transmittal shall be distributed as follows:

ASD/YZWD (Attn: DMO) ---------- 1 copy
ASD/YZAN ---------- 1 copy
Each recipient in Block 14 ---------- 1 copy

15. TOTAL

PREPARED BY	DATE	APPROVED BY	DATE

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5.0 SUMMARY.

This Primer has provided the LCC focal point with numerous samples of the LCC Management inputs needed in program documents which support the acquisition process. The samples, along with their supporting information, should be useful in developing acceptable LCC Management inputs to such documents as the Acquisition Plan, Program Management Plan, Request for Proposal, and Source Selection Plan. The reader is reminded that the inputs included in this Primer are just samples and that individual inputs must be tailored to the specific needs of a program. For further information concerning the information or assumptions provided in this Primer, the interested reader is directed to the Related Sources used in developing this Primer.

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Appendix A

Sample Life Cycle Cost/Design to Cost Plan

MISSILE-X
LIFE CYCLE COST/DESIGN TO COST PLAN

6 June 1977

Contract F04606-76-A-0087-R901

Prepared for

Department of the Air Force
Space and Missile Systems Organization (AFSC)
ICBM Program Office

CONTENTS

1
INTRODUCTION

1.1 PURPOSE

The purpose of the Missile-X (MX) life cycle cost/design-to-cost (LCC/DTC) program is to develop an affordable, minimum life cycle cost weapon system which meets performance requirements. The purpose of this plan is to present the ICBM Program Office approach to applying LCC/DTC concepts and techniques for the remaining MX weapon system development and production phases. The plan is prepared in response to, and in compliance with, the MX Program Management Plan.

1.2 SCOPE

This plan describes the tasks necessary to determine, evaluate, and control the LCC of the MX weapon system. The plan applies to all MX program elements and activities for which government or contractor resources will be required. The MX LCC/DTC program objectives are stated. An approach toward meeting these objectives is described by defining the management responsibility for the LCC/DTC program, the primary life cycle cost control concept, and specific tasks leading to the accomplishment of the objectives. The overall flow of tasks to be performed is described and the individual tasks and their interrelationships are defined. Responsibility for performing each task is assigned to a program participant, and supporting responsibilities are identified and defined. Finally, task schedules related to major design and program decision points are established.

Section 2 of this document states the LCC/DTC program objectives; Section 3 defines the approach toward meeting the objectives; Section 4 defines the tasks to be performed; Section 5 presents the task schedules; and Section 6 contains a glossary of terms used. While some of the earlier tasks have been partially completed, they are included in this document for the sake of perspective for the remaining tasks.

This plan will be updated when significant program changes occur.

2
LCC/DTC PROGRAM OBJECTIVES

2.1 PRIMARY OBJECTIVES

The primary objectives of the LCC/DTC program are:

a. Establish achieving minimum life cycle cost on a basis comparable with achieving weapon system performance.

b. Evaluate weapon system design and conduct trade studies to achieve a preferred balance among life cycle cost, performance, schedule, and risk.

2.2 IMPLEMENTING OBJECTIVES

In order to attain the primary objectives, the following implementing objectives must be met:

a. Establish life cycle cost as a significant design parameter in the development of the MX weapon system.

b. Ensure a working level cost consciousness in both Government and contractor personnel.

c. Provide management visibility into development, production, and operating and support (O&S) costs.

d. Identify weapon system cost drivers, including design parameters, program schedule, and O&S concepts.

e. Establish LCC/DTC ground rules which include standard cost element structure for use within the Program Office and for interface with contractors and other Government agencies.

f. Establish a weapon system cost goal and allocate goals, targets, and O&S factors to provide management objectives.

g. Provide tradeoff flexibility to Project Officers (POs) and contractors within their respective allocated goals and targets.

h. Estimate and report weapon system life cycle cost.

3
APPROACH

3.1 GENERAL APPROACH

The ICBM Program Office will utilize the associate contractor approach for developing and procuring the MX weapon system. The Program Office functions as the weapon system integrator. In this capacity, the Program Office performs system level tradeoffs among LCC, schedule, performance, and risk. The Program Office also performs tradeoffs among subsystems, and monitors and controls contractor tradeoffs within their respective subsystems. Each associate contractor will implement an LCC/DTC program integral to his development effort. This program will support Program Office life cycle costing while emphasizing visibility and control of unit production cost (UPC) and O&S factors.

The ICBM Program Manager is responsible for establishing and implementing the LCC/DTC program. He has designated an individual within the Systems Engineering Office as the manager for LCC/DTC activities. The LCC/DTC Manager will coordinate the LCC/DTC program and will chair the MX Life Cycle Cost Working Group (LCCWG). The LCCWG, comprised of representatives from AFSC, AFLC, SAC, ATC, and AFTEC, supports the application of LCC/DTC to the MX program by recommending implementing policies and procedures.

The ICBM Program Office will directly control development and production costs by implementing an LCC/DTC program. This will be accomplished by:

a. Prioritizing LCC/DTC activities

b. Identifying cost drivers

c. Establishing design-to-unit production cost (DTUPC) goals

d. Allocating DTUPC goals to Project Officers

e. Allocating DTUPC targets to contractors

f. Monitoring the status and LCC impact of UPC during the development program.

In addition, O&S costs will be controlled indirectly through the control the O&S factors having significant cost impact. This will be accomplished by:

a. Prioritizing O&S cost control activities

b. Identifying O&S factors which drive cost

c. Establishing system level goals for the identified factors

d. Allocating O&S goals to Project Officers

e. Incorporating O&S factor allocations into specifications and contractual provisions

f. Monitoring the status and cost impact of O&S factors during the development program.

Specific tools will be developed to improve cost visibility to aid in LCC management decisions. The Multiple Aim Point (MAP) weapon system LCC/DTC model will be developed and used to gain insight into cost sensitivity to various design parameters. The Scheduled Program Allocation of Resources and Costs (SPARC) model will be refined and used for developing weapon system LCC estimates and budgetary allocations. These cost models will interface and be compatible with other Program Office models, including operations, effectiveness, and engagement models.

3.2 SPECIFIC APPROACH

The specific approach to meeting the objectives of the MX LCC/DTC program is directed toward accomplishing the following items.

3.2.1 Establish LCC as a Significant Design Parameter

The emphasis in LCC control will be placed on design-to-unit production cost and control of O&S factors of the design.

a. The ICBM Program Manager will allocate cost and O&S goals to the Project Officers.

b. Contractors' proposals will include DTUPC and O&S parameter goals and provide supporting rationale.

c. The Program Office will negotiate the DTUPC targets with the contractors and will maintain a management reserve within their respective DTUPC goals for performance/cost flexibility.

d. Contractual incentives will be implemented where appropriate.

3.2.2 Ensure Working Level Cost Consciousness

The importance of cost as a design parameter and decision criterion will be emphasized at all levels of program participation.

a. The Program Office will develop a definitive LCC/DTC program plan.

b. The Program Office will communicate the emphasis on LCC/DTC in RFPs and bidders' briefings.

c. The Program Office will motivate contractors toward high levels of success in developing an affordable, minimum LCC weapon system meeting operational performance requirements.

d. Contractors will provide, as a part of their proposals, a plan for using cost as a design parameter in the configuration definition process.

e. Project Officers will be responsible for monitoring the LCC/DTC performance of their contractor. The Project Officer will include a review of LCC/DTC activities and status in program management reviews, design reviews, and TI meetings.

3.2.3 Provide Management Visibility

To ensure effective consideration of cost in management decisions, visibility into cost status, sensitivities, risks, and estimates will be provided throughout this program.

a. The Program Office will establish data items that require contractors to submit appropriate cost and design information to support sound management decisions during the design process.

b. Project Officers will report cost and design status to the Program Manager, comparing status to the allocated goals.

c. The LCC/DTC Manager will monitor Project Officer inputs to the system LCC model and identify contracts needing Program Manager attention.

d. The Program Office will report the weapon system LCC goal, the missile DTUPC goal, and costing status to AFSC, Hq USAF, and DoD.

3.2.4 Identify Weapon System LCC Drivers

To aid in prioritizing LCC control activities, the Program Office will identify the design parameters, schedule factors, and O&S concepts of parameters which have the maximum impacts on weapon system LCC.

a. Each PO will investigate analogous systems to identify cost drivers. The POs will develop quantitative relationships between the design, production, and O&S cost drivers, where applicable.

b. Each PO will further identify and quantify cost drivers using contractor data reported under DID UF-7-SAMSO, engineering judgment, inputs from functional experts, and early demonstration test results.

c. POs will assess the cost impact of development schedules on their respective elements. They will identify schedules that are causing cost increases or risks, and report them to the Program Manager along with recommended corrective actions and anticipated savings.

3.2.5 Establish LCC/DTC Ground Rules

The Program Office Program Control Directorate will establish and document a set of standard costing ground rules to ensure compatibility among costing activities. The ground rules will define:

a. Those elements of UPC that are included in the POs' cost goals and in the the cost targets negotiated with contractors

b. Rules of cost accounting for GFE

c. Baselines for quantities, rates, and delivery schedules and procedures for adjusting them

d. Rules for estimating base year, current year, and then-year costs

e. A standard cost element structure for all program phases, encompassing hardware, software, and services.

3.2.6 Establish a Weapon System LCC Goal and Allocate Cost Targets and O&S Factors

The Program Office will establish a weapon system LCC goal to be reported to AFSC, Hq USAF, and DoD. Within the Program Office, this total goal will be

divided and allocated to the POs as cost and O&S parameter goals. The allocated goals then become PO management objectives.

a. Project Officers will recommend DTUPC and O&S parameter goals for their respective elements.

b. The MX System Engineering Office will combine these goals, assess their acceptability in terms of overall weapon system performance requirements, and prepare recommended actions for the Program Manager.

c. The Program Manager will combine the goals to establish the weapon system LCC, and adjust and allocate DTUPC and O&S parameter goals to the POs. A management reserve will be retained by the Program Manager.

d. The Program Office will recommend the weapon system LCC goal and a missile DTUPC goal to DSARC II. The cost goal established by DoD in the MX Decision Coordinating Paper (DCP) will become an agreement between the Program Manager and DoD.

e. The Program Manager will make equitable adjustment to PO goals, within the weapon system LCC goal, in the event of cost or design impact due to influences outside the control of the PO, such as 1) lack of funding, 2) changes in program requirements, 3) major redefinition of interfaces, or 4) results of conclusive trade studies.

3.2.7 Develop a Contract Management Structure to Encourage Cost Control

The Program Office will establish contracting relationships that encourage cost control and design versus cost trades within system performance requirements.

a. The Program Office will develop an acquisition program and specifications that encourage flexibility of design innovation and alternative approaches within contractual targets.

b. The Program Office will apply contractual provisions to minimize LCC. Specific incentives will be tailored to the individual procurement, and will emphasize the control of cost driving parameters.

c. The Program Office will consider LCC/DTC as a factor in source selection.

d. The POs will accommodate cost uncertainties by conducting trades within their respective goals.

3.2.8 Estimate and Report Weapon System LCC

The Program Office will estimate and report weapon system LCC as an overall indicator of cost status and compliance with DCP requirements.

a. The POs will provide baseline inputs to MNPC for their respective elements.

b. SAC, AFLC, ATC, and AFTEC, through the LCCWG, will provide submodels to generate estimates of O&S portions of weapon system LCC.

c. MNPC, using the SPARC model, will generate weapon system LCC estimates. A baseline estimate will be developed during the Validation Phase. MNPC will update the estimate as required.

d. MNP will present the LCC estimates to program management at monthly management reviews.

e. The POs will report potential problem areas and variances from cost goals to the Program Manager as part of program element presentations.

f. The Program Manager will report variances from the weapon system LCC goal as part of the Program Assessment Review (PAR).

4
LCC/DTC TASKS

This section defines tasks to be performed in implementing the approach to meeting the objectives of the MX LCC/DTC program. The tasks are broken into subtasks, each of which is described in terms of the functions to be performed, the office of primary responsibility (OPR), prerequisites for performance, output, use of output, and guidance or directive documentation.

The overall flow of tasks listed below is shown in Figure 4-1.

1. Establish Methodology - Define ICBM Program Office LCC/DTC policy and guidance, combined with established USAF and DoD policy, and develop a specific plan of action, tailored to the MX program.
2. Establish LCC/DTC Ground Rules - Define accounting rules and procedures for all MX program phases to standardize costing efforts and ensure compatibility among cost estimates and modeling activities.
3. Develop and Maintain LCC/DTC Data Base - Establish within the Program Office a data base to allow design trade studies and cost estimating. Update the data base to represent current system design and concepts.
4. Develop and Update LCC/DTC Models - Develop models as tools to aid the program participants in estimating LCC, performing design trade studies, and making management decisions.
5. Generate and Update Cost Estimates
6. Allocate Cost Goals/Targets - Allocate the weapon system goal among the subsystems, to serve as management objectives for POs and incentive targets for contractors.
7. Manage LCC/DTC Program - Compare cost estimates with cost goals and identify deviations and problem areas.

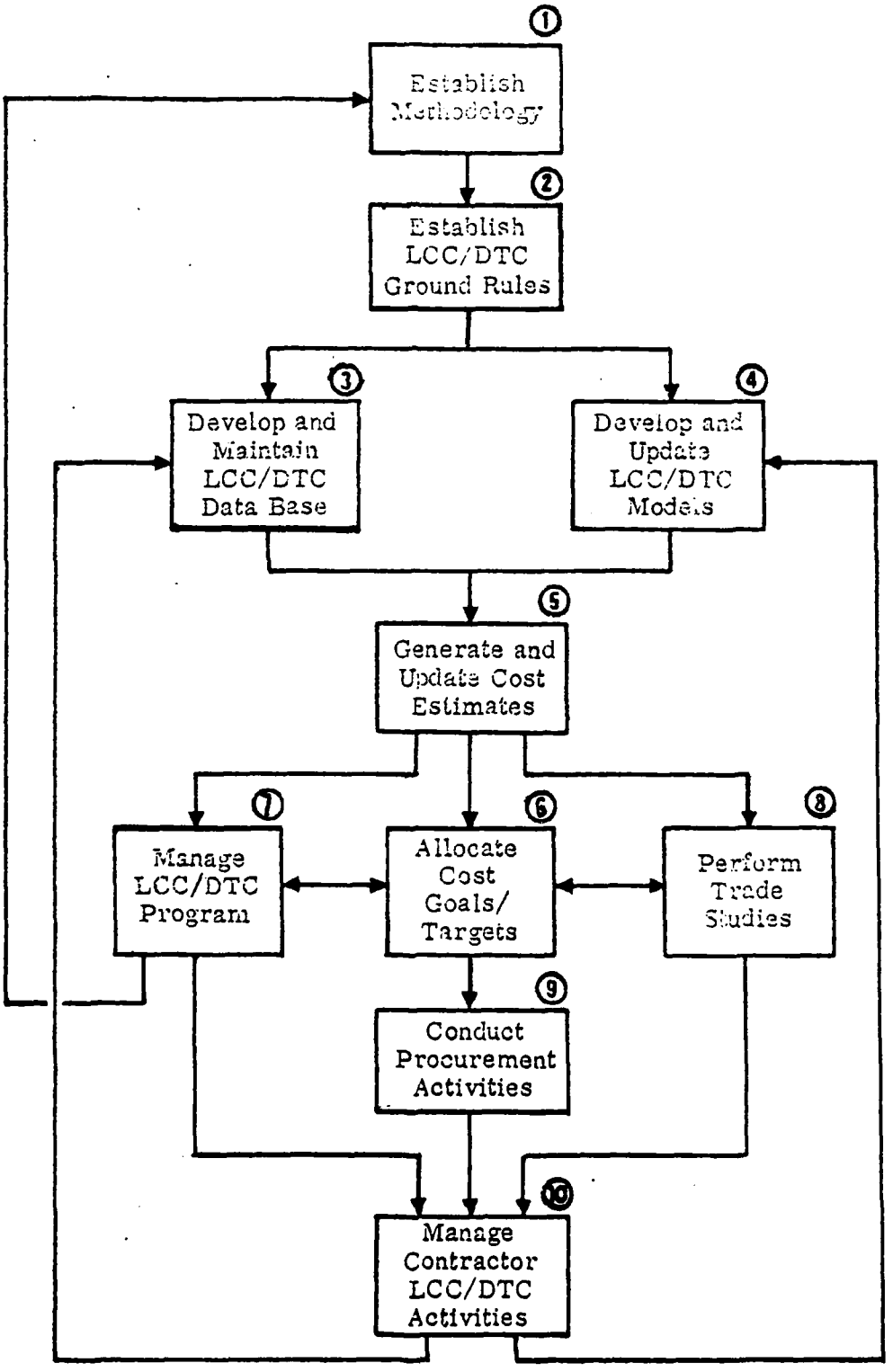

Figure 4-1. LCC/DTC Task Flow

Tasks	ICBM Program Office									LCCWG	SAMSO/(LA)		Other Commands				Contractors
	MN	MNNX	PO	MNN	MNB	MNC	MNL	MNP	MNT		AWL	ACC	SAC	AFLC	AFC	AFTEC	
1. Establish Methodology	Approval	Primary	Support	R&C	R&C	R&C	R&C	R&C	R&C	Support	R&C		R&C	R&C	R&C	R&C	R&C
2. Establish LCC/DTC Ground Rules	Approval	Support	Support	Support		R&C	R&C	Primary		Support	R&C	R&C	R&C	R&C	R&C	R&C	R&C
3. Develop and Maintain LCC/DTC Data Base		Support	Support	Support	Support		Support	Primary	Support	Support			Support	Support	Support	Support	Support
4. Develop and Update LCC/DTC Models		Primary	Support	Support	R&C	R&C	R&C	Primary	R&C	Support			Support	Support	Support	Support	Support
5. Generate and Update Cost Estimates		Support	Support	Support	Support		Support	Primary	Support	Support		ICA/ICE	Support	Support	Support	Support	Support
6. Allocate Cost Goals and Targets	Approval	Primary	Primary	Support	Support	R&C	Support	Support	Support	R&C			R&C	R&C	R&C	R&C	Support
7. Manage LCC/DTC Program		Primary	Support	Support				Support		R&C							
8. Conduct Trade Studies	Approval	Primary	Primary	Support	Support	R&C	Support	R&C	R&C	Support			R&C	R&C	R&C	R&C	Support
9. Conduct Procurement Activities	Approval	Support	Primary	Support	Support	Primary	Support	Support	Support	Support	R&C		Support	Support			Support
10. Manage Contractor LCC/DTC Activities		Support	Primary	Support	Support	Primary	Support	Support	Support								

R&C - Review and comment
ICA - Independent cost analysis
ICE - Independent cost estimating

Figure 4-2. Responsibility Summary

8. Perform Trade Studies - Investigate the cost impacts of alternative designs and concepts to allow selection of the minimum LCC system configuration meeting performance requirements.

9. Conduct Procurement Activities - Structure contracts to allow design flexibility within the established targets and to encourage innovation.

10. Manage Contractor LCC/DTC Activities - Monitor contract design efforts to reach low cost solutions, evaluate contractor performance, assess contractor input data and evaluate design status, and direct contractor activities regarding design and cost trades.

As indicated in Figure 4-1, the output from the management of contractor activities provides updated inputs to the Program Office data base, thereby enabling evaluation of current status and progress. Contractor activities will also include development of detailed subsystem models that will be incorporated into Program Office models. At key program decision points, or as a result of major program redefinition/redirection, the Program Office will reassess the LCC/DTC methodology and revise it as necessary.

4.1 LCC/DTC MANAGEMENT

Figure 4-2 summarizes the program participants' responsibilities for LCC/DTC tasks. The subtask descriptions providing detailed definition of responsibilities, indicating the OPR for each subtask, and identifying organizations with support roles are listed below.

4.2 LCC/DTC TASKS

4.2.1 Establish Methodology

4.2.1.1 Formulate Guidance

OPR: SAMSO/MN with support from MNNX and LCCWG

TASK DEFINITION: Review and update LCC/DTC policy and guidance from higher headquarters. Establish and periodically review the MX-specific LCC/DTC policy of the ICBM Program Manager. Review program requirements in the context of LCC/DTC objectives. Require using and support commands to clarify the definition of program requirements that actively constrain LCC control efforts. Assess the cost, payoff, and practical feasibility of implementing specific LCC/DTC objectives.

PREREQUISITES: MX weapon system concept and program plans defined. System objectives established.

OUTPUT: MX-specific guidance for implementation of LCC/DTC objectives

USE OF TASK OUTPUT: The ICBM Program Office LCC/DTC policy statement will serve as a guide in the tailoring and development of LCC/DTC techniques for application to the MX program. The policy statement will become Section 3.0 of this document. Approaches adopted for assignment of cost goals, tracking costs, evaluation of tradeoffs, and the structuring of contracts to implement LCC/DTC objectives must be in accordance with this guidance.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 5000.1	Major System Acquisition
DoDD 5000.2	Major System Acquisition Process
DoDD 5000.28	Design to Cost
DoDD 4105.62	Selection of Contractual Sources for Major Defense Systems
AFR 800-11	LCC/DTC Implementation
AFLC/AFSCP 800-19	Joint Logistic Commanders' Guide on Design to Cost
	Joint AFSC/AFLC Commanders' Working Group for LCC, Supplemental LCC Program Management Guidance, January 1976

4.2.1.2 Formulate and Document Methodology

OPR: SAMSO/MNNX with support from LCCWG

TASK DEFINITION: Review lessons learned on earlier applications of LCC/DTC concepts and techniques. Develop tailored statements of objectives, approach, tasks, schedules, and responsibilities. Review and update methodology periodically to incorporate program changes, resource limitations, and practical constraints to implementation.

PREREQUISITES: Program Office guidance established MX Program Management Plan available. Participants identified and their authorities defined.

OUTPUT: The MX LCC/DTC Plan (this document)

USE OF TASK OUTPUT: Define and consolidate MX LCC/DTC objectives, approach, tasks, schedules, and responsibilities.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

MX Program Management Plan, ICBM Program Office Organization and Operating Instructions

4.2.1.3 Disseminate Plan

OPR: SAMSO/MN

TASK DEFINITION: Approve and distribute the LCC/DTC Plan to MX program participants. The dissemination of LCC/DTC objectives and approach is an on-going process at all levels in the MX program. This document is one part of that dissemination process. Dissemination also includes clear communication of LCC/DTC objectives and direction by all management levels. Project Officers will ensure that RFPs and bidders' briefings emphasize Program Office concern for life cycle cost control. Offices conducting design reviews will ensure explicit consideration of DTC goals and controllable factors driving O&S costs.

PREREQUISITES: LCC/DTC Plan completed.

OUTPUT: DoD, Program Office, and contractor awareness of LCC/DTC objectives and approaches to LCC control

USE OF TASK OUTPUT: Guide LCC/DTC activities.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFLC/AFSCP 800-19	Joint Logistics Commanders' Guide on Design to Cost

4.2.2 Establish LCC/DTC Ground Rules

OPR: MNPC with support from LCCWG

TASK DEFINITION: Provide explicit documentation of LCC/DTC ground rules to the Program Office and to the contractors. The ground rules will include, as a minimum, a standard cost element structure; the elements of unit production cost that

are included in POs' cost goals and in targets negotiated with contractors; rules for GFE; baselines and adjustment approaches for quantities, rates, and delivery schedules; and rules for applying base year, current year, and then-year dollars.

PREREQUISITES: MX program, system definition, and configuration available

OUTPUT: A published document defining LCC/DTC ground rules

USE OF TASK OUTPUT: The ground rules will provide the structure under which costs will be estimated, cost goals allocated, trade studies performed, and costs and L&S factors reported and tracked by POs and contractors. The LCC/DTC ground rules will clarify the application of DTC principles to software and support services.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

MIL-STD-881	Work Breakdown Structures
	MX Program Breakdown Codes and Dictionary
MNOI 800-2	MX Life Cycle Cost Management
AFR 173-10	USAF Cost and Planning Factors
AFSCM 173-1	Cost Estimating
MNOI 173-1	Cost Analysis

4.2.3 Develop and Maintain LCC/DTC Data Base

4.2.3.1 Assemble Initial LCC/DTC Data Base

OPR: SAMSO/MNPC with support from the LCCWG

TASK DEFINITION: Assess needs for and sources of cost-related data. Require SAC, AFLC, ATC, AFTEC, and POs to provide inputs from historical data bases from Minuteman, analogous basing subsystems and components, non-proprietary contractor cost data, other industry sources, and other relevant DoD cost sources (e.g., Navy Trident programs, Army Construction Engineering Research Laboratory, and data from the Ogden weapon system logistic evaluations). Compile information on analogous learning curves, aerospace and construction price indices, and anticipated requirements changes or system configuration options as inputs for LCC modeling. Conduct development of the initial data base in parallel with the tailoring and

expansion of the SPARC model and initial development of the MAP weapon system LCC/DTC model.

PREREQUISITES: Costing ground rules established. Concurrent development of LCC/DTC models.

OUTPUT: A refined, usable collection of quantitative and qualitative information on cost-related factors. Summary and some raw data will reside in MNPC; more detailed information and raw data with Project Officers.

USE OF TASK OUTPUT: Develop baseline program cost and budgetary estimates. Provide a baseline input for trade studies and preliminary cost goal allocations. Provide baseline inputs to identify cost drivers and sensitivities.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFSCM 173-1	Cost Estimating
MNOI 173-1	Cost Analysis

4.2.3.2 Revise and Expand Data Base with Validation Phase Information

OPR: SAMSO/MNPC with support from POs and MNNX

TASK DEFINITION: Assess and define specific data requirements for validation. Review completed AFSC Form 40s for contractor-deliverable data items to be defined on DD Form 1423s. Acquire data from contractors and independent sources to support trade studies and as specific inputs to the MAP weapon system LCC/DTC and SPARC models. MNNX will structure AFSC Form 40s requiring minimum reformatting or unique LCC/DTC reporting. Incorporate data inputs into the Program Office data base and update data base documentation.

PREREQUISITE: Task 4.2.2 complete. Validation contracts initiated. Task 4.2.3.1 completed.

OUTPUT: Requirements for CDRL items; revised data base and documentation.

USE OF TASK OUTPUT: Constitutes inputs to 1) revising LCC budgetary estimates by phases and total program, 2) improving understanding of cost sensitivities to hardware configurations and employment concepts, 3) evaluating system designs using effectiveness models, and 4) establishing and evaluating cost goals.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

SAMSO Data Ordering Procedures

4.2.3.3 Refine and Expand Data Base with FSD Phase Information

OPR: SAMSO/MNPC with support from POs, MNB, and MNNX

TASK DEFINITION: Review and refine the MX LCC/DTC data base as the program progresses and system definition improves. Incorporate updated information into the data base to accommodate changes in MX program definition and to interact with MAP weapon system LCC/DTC model and SPARC model refinements. Evaluate data from contractor activities, Air Force RDT&E, and independent analyses to 1) reduce uncertainty in hardware parameter values, 2) increase understanding of cost drivers and sensitivities, and 3) provide insight into manufacturing costs and producibility. Evaluate the information gained from working with updated designs and improved support scenario parameters available as a result of LSA. Assess the need for additional data on a continuing basis. Identify opportunities to reduce or redefine other data requirements.

PREREQUISITES: Tasks 4.2.2, 4.2.3.1, and 4.2.3.2 complete. FSD contracts initiated.

OUTPUT: Refined data base reflecting FSD designs; reassessment of data requirements.

USE OF TASK OUTPUT: Provide inputs to 1) refining LCC budgetary estimates for production, deployment, operation, and support, 2) FSD cost-effectiveness and design trade studies, 3) reviewing cost goals, 4) assessing Engineering Change Proposals, and 5) procurement package planning.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.3.4 Update Data Base with Detailed Production and Deployment Information

OPR: SAMSO/MNPC with support from PO, MNB, and MNT

TASK DEFINTION: Collect data from early production to fit learning curves and to identify shifts in slope or origin of learning curves. Assemble and analyze IOT&E data, with particular attention to refining estimates of O&S factors that drive costs. Reduce and analyze detailed data from test activities and weapon system deployment to improve cost estimates of alternative employment concepts still under consideration.

PREREQUISITES: Tasks 4.2.2, 4.2.3.1, 4.2.3.2, and 4.2.3.3 complete. Production contracts initiated. Deployment initiated.

OUTPUT: Detailed cost data on production cost elements, learning curves, K-factors to adjust for field use, refined estimates of O&S cost drivers

USE OF TASK OUTPUT: Provide inputs to 1) improving cost estimates of alternative O&S procedures still under consideration, 2) improving weapon system LCC estimates for budgetary purposes, and 3) verifying attainment of DTUPC and O&S goals.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.4 Develop and Update LCC/DTC Models

4.2.4.1 Revise and Expand SPARC Model

OPR: SAMSO/MNPC

TASK DEFINITION: Expand and refine the basic SPARC model for generating Program Office LCC estimates. SAC, AFLC, ATC, and AFTEC, working through the LCCWG, will assist the Program Office in specifying model requirements and in tailoring the SPARC model by providing updated and tailored subroutines in their respective areas of expertise. Define interfaces, especially operational interfaces, with effectiveness/employment models. Update and refine the model structure as the quality of the data base improves and major program changes occur. Implement the revised version of SPARC on the Program Office computer. Document the expanded

model to show assumptions and ground rules included, data input requirements, cost algorithms used, execution options provided, output modes available, and execution procedures.

PREREQUISITES: SPARC model available. Task 4.2.2 complete; Tasks 4.2.3.1 through 4.2.3.4 in progress. Program Office computer identified.

OUTPUT: Expanded and tailored SPARC model implemented on Program Office computer.

USE OF TASK OUTPUT: SPARC will be used to generate LCC estimates for budgetary planning and reporting to higher headquarters.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.4.2 Develop and Update MAP Weapon System LCC/DTC Model

OPR: SAMSO/MNNX with support from the LCCWG

TASK DEFINITION: Define and develop MAP weapon system LCC/DTC model which will utilize the initial data base assembled under Task 4.2.3.1 Develop the logical structure to emphasize subsystem trades and alternative weapon system hardware configurations and O&S concepts. Define interface requirements with the expanded SPARC model, detailed PO/contractor cost models, and effectiveness/employment models. Update the model structure or expand its capabilities, as necessitated by program changes and the evolving data base. Expand the detail of subsystem and O&S trade capabilities as data become available from development, test, and deployment. Perform configuration control over the model.

Document the model to provide a user operating manual that defines and explains cost algorithms, assumptions made, data inputs, costing features built into the coding, analysis options available, and output modes. Update the documentation, as necessary, to reflect revisions to the model.

PREREQUISITES: Task 4.2.2 complete; Tasks 4.2.3.1-4.2.3.4 on-going. Program Office computer defined. Other models defined.

OUTPUT: The MAP weapon system LCC/DTC model and associated documentation

USE OF TASK OUTPUT: The MAP model will aid in assessing the LCC impact of alternative system and subsystem configurations and O&S concepts. The model will highlight cost sensitivities and will aid in the establishment and review of cost goals. Inputs to the model will define alternatives for evaluation, and outputs will provide data to aid in management decisions regarding the alternatives.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.4.3 Develop PO/Contractor LCC/DTC Models

OPR: Project Officers with support from MNNX

TASK DEFINITION: Individual POs will identify requirements for detailed LCC/DTC modeling activities for their respective elements. POs will provide contractors with detailed clarification of LCC/DTC ground rules as they pertain to such models. Monitor development of contractor models to assure compliance with ground rules and compatibility with other models. MNNX may incorporate portions of contractor models into the MAP weapon system LCC/DTC model, as part of Task 4.2.4.2.

PREREQUISITES: Task 4.2.2 complete. MAP weapon system LCC/DTC model defined. Development contracts awarded.

OUTPUT: Detailed LCC/DTC element models

USE OF TASK OUTPUT: Specification of model requirements and detailed LCC/DTC ground rules will aid contractors in trade studies and cost allocations. Detailed models at the Program Office will aid in 1) goal allocation, 2) review and verification of contractor-developed study results, and 3) development of improved LCC estimates and trade study data.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.5 Generate and Update Cost Estimates

4.2.5.1 Develop Baseline Estimates

OPR: MNPC with support from LCCWG, POs, MNB, and MNNX

TASK DEFINITION: Access the initial data base and early PO parametric analyses to provide detailed inputs to the MAP weapon system LCC/DTC model. Exercise the model and combine outputs with best estimates (where parametric analyses are not feasible to generate inputs to the tailored SPARC model. POs will develop pessimistic and optimistic ranges on parameters and estimate subjective confidence intervals around point estimates of such factors as subsystem unit production cost and O&S cost of alternative employment concepts. MNPC will exercise the SPARC model to provide the Program Office baseline LCC estimate for the MX weapon system.

PREREQUISITES: Tasks 4.2.2, 4.2.3.1, 4.2.4.1, and 4.2.4.2 complete. Weapon system and program plans defined.

OUTPUT: A life cycle cost estimate of the baseline weapon system configuration/ employment concept

USE OF TASK OUTPUT: Provide initial program estimates for planning purposes and to aid in allocation of preliminary cost goals. Provide preliminary identification of cost drivers for early directing of sensitivity studies. Aid in identifying areas of greatest cost uncertainty so that additional analytical resources may be committed. Aid in assessing the reasonableness of contractor estimates. Provide a point of reference to aid in variance analysis as the program progresses, and to assess LCC impacts of proposed program changes.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFR 173-1	Management of the Cost Analysis Program
AFR 800-11	LCC/DTC Implementation
AFSCM 173-1	Cost Estimating
MNOI 173-1	Cost Analysis
MNOI 800-2	MX Life Cycle Cost Management

4.2.5.2 Develop Revised LCC/DTC Cost Estimates

OPR: SAMSO/MNPC with support of LCCWG, Project Officers, MNB, and contractors.

TASK DEFINITION: Revise and update LCC estimates when 1) significant program planning (funding and/or scheduling) changes occur, 2) significant changes to the system design occur, 3) significant changes in methods of fabrication/production of hardware occur, or 4) significant cost or requirements inputs are received. POs will provide revised subsystem/unit cost details as inputs to the MAP weapon system LCC/DTC model. These will include revised estimates of cost risk/uncertainty. Exercise the SPARC model to generate the updated Program Office LCC estimate.

PREREQUISITES: SPARC and MAP weapon system LCC/DTC models implemented. Task 4.2.3.1 completed; Tasks 4.2.3.2-4.2.3.4 on-going.

OUTPUT: A revised life cycle cost estimate for the weapon system; variance in LCC from baseline estimate.

USE OF TASK OUTPUT: Provide current cost information and indication of cost uncertainty to assess LCC/DTC status of the MX program, and to track progress in the achievement of cost goals/targets. Support trade studies at the system or weapon system level. Aid in assessing Engineering Change Proposals and the reasonableness of contractor estimates. Aid in evaluation of contractor requests for change in DTC targets, where increased development or production expenditure may significantly reduce total LCC.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 4105.62	Selection of Contractual Sources for Major Defense Systems
AFR 173-1	The Air Force Cost Analysis Program
AFR 800-11	LCC/DTC Implementation
MNOI 800-2	MX Life Cycle Cost Management

4.2.5.3 Independent Cost Analysis and Independent Cost Estimating for Verification/Validation

OPR: SAMSO/ACCE

TASK DEFINITION: Carry out Independent Cost Analysis (ICA) and/or Independent Cost Estimating (ICE) subsequent to each design review, at other major program milestones, and in conjunction with any major program redirection. The ICA/ICE will include a form of cost risk assessment. These must follow carefully the LCC/DTC ground rules identified in Task 4.2.2, and may suggest revisions to those rules.

PREREQUISITES: Task 4.2.2 complete.

OUTPUT: An independent cost analysis/independent cost estimate

USE OF TASK OUTPUT: Provide independent verification/validation of Program Office and contractor cost estimates. Provide ICA/ICE input for the DSARC process.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 5000.4	OSD Cost Analysis Improvement Group
AFSCM 173-1	Cost Estimating
MNOI 173-1	Cost Analysis

4.2.6 Allocate LCC Into DTUPC Goals/Targets and O&S Factors

4.2.6.1 Preliminary Allocation of DTUPC Goals and O&S Factors

OPR: MNNX jointly with PO, MNL, and MNB, for Program Manager's approval

TASK DEFINITION: Project Officers will review the LCC/DTC ground rules established under Task 4.2.2. Using these and the latest program information on quantities, rates, schedules, procurement approach, etc., each PO will estimate first-unit production cost and learning curve for his assigned subsystems or configuration items. Project Officers will use maintenance data, cost of analogous subsystems/units, contractor data, industrial engineering estimates from preliminary designs, and collective "expert judgment" in estimating production costs. The POs will propose preliminary DTUPC goals that include an identified management reserve based on cost and requirements uncertainty. These proposed goals will be reviewed by MNNX and

the Program Manager. The Program Manager, assisted by MNNX, will combine those goals and compare them to top-level numbers, i.e., funding profiles. The Program Manager will then revise the goals, as necessary, and allocate a preliminary DTUPC goal to each PO. If one PO's responsibility divides into two or more elements, a procedure similar to the above will be followed to allocate a DTUPC goal to each element.

The POs will likewise propose preliminary goals on principal O&S factors. They will determine these goals based on experience on analogous elements, analyses, experiments or tests, using and supporting commands and contractor feedback, and engineering judgment. Project Officers will emphasize reliability, maintainability, personnel requirements, support equipment, principal consumables, nuclear hardness and survivability, safety, and producibility. MNNX, MNNX-S, MNT, MNB, and MNL will conduct a system-level evaluation of the aggregate of the PO preliminary O&S goals to ensure overall weapon system performance requirements are met. The Program Manager will then allocate to POs preliminary goals on specified O&S factors.

PREREQUISITES: Costing and support analytical tools available. Tasks 4.2.2 and 4.2.3.1 complete.

OUTPUT: Preliminary DTUPC and O&S factor goals for each PO

USE OF TASK OUTPUT: Provide a baseline to aid in variance analysis and as documentation for future reference. Provide the baseline analysis for establishing firm goals.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFLC/AFSCP 800-19	Joint Logistic Commanders' Guide on Design to Cost

4.2.6.2 Establish Cost Targets and O&S Factors for FSD Contracts

OPR: SAMSO/MNNX with support from POs, MNL, and MNB, for Program Manager approval

TASK DEFINITION: Establish proposed DTUPC goal for each contract prior to the release of the Full Scale Development RFP for that element. Base the proposed contract DTUPC goal on the preliminary DTUPC goal analysis, updated

information in the LCC/DTC data base, program changes, expected contract price, and cost/risk analysis.

Review contractor-proposed DTUPC goals during source selection. Prepare a recommendation regarding contractual DTUPC targets for Program Manager's approval. Negotiate the DTUPC target with the contractor prior to Missile Design Review (MDR).

The PO will include O&S factors in element specifications for inclusion into FSD contracts. Base the specifications on the preliminary O&S factor analyses indicated in Task 4.2.6.1, updated with information from test and evaluation, LCC models, trade studies, program changes, and assessment of uncertainty in meeting O&S goals.

PREREQUISITES: Tasks 4.2.2, 4.2.5.1, and 4.2.6.1 complete.

OUTPUT: Project Officer and negotiated DTUPC targets; contractually specified O&S factors.

USE OF TASK OUTPUT: Establish baseline reference for contractor performance evaluation.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.6.3 Revise Goals/Targets and O&S Factor Allocations

OPR: SAMSO/MNNX with support from MNL and MNB, for Program Manager's approval

TASK DEFINITION: Reallocate cost or O&S parameter goals, updating the process of Tasks 4.2.6.1 and 4.2.6.2. Element goals established between the Program Manager and POs will be revised when directed program changes occur; significant changes are directed in element performance requirements, employment concepts, or the interfaces; or an expenditure shift of "investment" is judged likely to result in lower weapon system LCC. Minor perturbations of the program or requirements will generally be absorbed by the established target.

PREREQUISITES: Tasks 4.2.5.2, 4.2.6.1, 4.2.6.2, and 4.2.7. A major event necessitating goal updating.

OUTPUT: Reviewed and documented cost goal/target and/or O&S factor revision

USE OF TASK OUTPUT: Provide flexibility in attaining weapon system cost goal. Achieve a better balance of life cycle cost, performance, schedule, and risk among subsystems. Update PO goals, as necessary, to reflect current requirements, program plan, and employment concepts.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 5000.28	Design to Cost

4.2.7 Manage LCC/DTC Program

OPR: SAMSO/MNNX

TASK DEFINITION: Manage (with the support of the LCCWG) the implementation of the LCC/DTC program to ensure that the objectives are met. Monitor cost reporting and estimating from non-contractor sources, e.g., SAC Headquarters, Ogden ALC, and AFTEC. Evaluate contractor and Air Force test and evaluation data to evaluate success in meeting O&S factor goals. Review trends away from allocated DTC goals (as indicated by variance reports) with the MX Program Manager. Identify O&S variations to the LCCWG. Assist the Program Manager in reviewing, with Air Force and OSD, opportunities for significant LCC reduction through increased unit production cost.

PREREQUISITES: This MX LCC/DTC Plan.

OUTPUT: Program LCC/DTC status reports. May include variance reports, reports on weapon system O&S factors, and recommendation/justification for change in DTUPC goal.

USE OF TASK OUTPUT: Provide current and projected LCC/DTC status for the weapon system. Used as a basis for program management evaluation of the LCC/DTC efforts and for reporting to higher headquarters. Used as an aid in identifying potential LCC control problem areas. The LCCWG will update parameters for the SPARC model and factors that drive O&S costs.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFLC/AFSCP 800-19	Joint Logistic Commanders' Guide on Design to Cost

4.2.8 Perform Trade Studies

4.2.8.1 Identify Potential Tradeoff Areas

OPR: SAMSO/MNNX supported by Project Officers and contractors

TASK DEFINITION: Project Officers will identify to MNNX trade studies being conducted that fall within the PO's specific area of responsibility. Include trade studies directed by the PO and those performed by the contractor in conjunction with ECP submittals. Project Officers will identify to MNNX trade studies to be conducted that are outside of the PO's area of responsibility or involve more than one PO. MNNX (with the support of the LCCWG) will identify trade studies involving more than one PO's responsibilities. Areas for tradeoff will be suggested by 1) experience from other DoD programs, 2) new technologies or processes that allow cost reduction while meeting performance requirements, and 3) areas where a reduction in performance would not compromise the essential weapon system requirements. MNNX will maintain a file of all tradeoff areas for use in DSARC presentation.

PREREQUISITES: System and subsystems defined; Tasks 4.2.5 and 4.2.7.

OUTPUT: Documented file of trade studies

USE OF TASK OUTPUT: Form basis of trade studies to be performed by contractors or within the Program Office. Provide checklist of trade study progress. Provide file of trade studies for DSARC preparation.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

SAMSO Data Item Description UF-7

4.2.8.2 Conduct Trade Studies

4.2.8.2.1 Trade Studies Conducted by Project Officers

OPR: Project Officers with support from contractors

TASK DEFINITION: Conduct trade studies for areas that are within the PO's area of responsibility and within the PO's cost goal allocation and management reserve. The contractor is to prepare trade study data packages for Program Office decisions in trade studies requiring adjustment of cost target(s), involving non-compliance with

the contract, or impacting other contracts and subsystems. Trades which affect the PO's DTUPC goal or O&S factors must be referred to Systems Engineering (MNNX) and the Program Manager.

PREREQUISITES: Tasks 4.2.3, 4.2.4, 4.2.5, and 4.2.8.1

OUTPUT: Trade study reports with recommendations

USE OF TASK OUTPUT: Aids in Project Officer decisions with respect to tradeoff areas. Aids in meeting DTUPC goals, controlling O&S factors, and reducing weapon system LCC.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFLC/AFSCP 800-19	Joint Logistic Commanders' Guide on Design to Cost

4.2.8.2.2 Trade Studies Conducted by Systems Engineering

OPR: SAMSO/MNNX with support from MNB, MNL, Project Officers, and LCCWG

TASK DEFINITION: Direct trade studies in areas involving more than one Project Officer's area of responsibility and trade studies requiring consideration of weapon system effectiveness or cost and O&S goals. Request specific assistance from SAC, through the LCCWG, for trades involving weapon system effectiveness. Request specific assistance from MNB, MNL, and (through the LCCWG) AFLC and SAC for trades involving O&S parameter goals.

PREREQUISITES: Tasks 4.2.3, 4.2.4, 4.2.5, and 4.2.8.1

OUTPUT: Trade study report with recommendations

USE OF TASK OUTPUT: Aids in Program Manager decisions with respect to the tradeoff area. Aids in balancing and reviewing DTUPC goal allocations. Provides data for DSARC reviews.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.9 Conduct Procurement Activities

4.2.9.1 Provide Approach in Procurement Plan (PP)

OPR: SAMSO/MNCA with support from POs and MNNX

TASK DEFINITION: Review with MX LCC/DTC methodology and LCC/DTC ground rules. Combine that information with MX program plans and schedules to structure a description of the overall procurement approach for inclusion in the PP. Review recommendations from MNNX regarding appropriate contract structures and incentive arrangements for specific procurements. Modify approaches as necessary and summarize in the PP.

PREREQUISITES: Tasks 4.2.1 and 4.2.2 complete. Baseline cost goals established within the Program Office.

OUTPUT: A statement of the Program Office approach to MX procurement

USE OF TASK OUTPUT: Provide contractual approach to implement LCC/DTC objectives.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

	MX Program Management Plan
DoDD 5000.1	Acquisition of Major Defense Systems
DoDD 5000.2	Major System Acquisition Process

4.2.9.2 Develop SOW Inputs

OPR: SAMSO/MNCP with support from POs and MNNX

TASK DEFINITION: Develop statement of work inputs to define specific contractor tasks related to LCC/DTC. Task the contractors to 1) develop and implement an LCC/DTC program within their development effort, 2) determine cost drivers, 3) establish cost targets and allocate them to lower WBS levels, 4) generate LCC estimates and data bases, 5) conduct LCC/DTC trade studies and utilize results in design decisions, and 6) take steps to reduce risks in their respective developments. Develop a tailored SOW input for each procurement. Consider recommendations from MNNX and the POs regarding the content of the SOW tasks.

PREREQUISITES: Task 4.2.9.1 complete.

OUTPUT: Tailored SOW tasks for individual procurements

USE OF TASK OUTPUT: Provide tasks in RFP to direct contractor activities with regard to LCC/DTC.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

	MX Program Management Plan
DoDD 5000.1	Acquisition of Major Defense Systems
DoDD 5000.2	Major System Acquisition Process
DoDD 5000.28	Design to Cost
AFR 800-11	LCC/DTC Implementation

4.2.9.3 Develop LCC/DTC-Related Data Requirements

OPR: SAMSO/MNBD, based on inputs from Project Officers, MNB, MNNX, and MNPC

TASK DEFINITION: Project Officers will define the minimum information requirements necessary to satisfy the design and cost monitoring activities of Tasks 4.2.3, 4.2.5, 4.2.6, and 4.2.7. Whenever feasible, define reports to be in contractor's format. MNBD will solicit recommendations from POs for data requirements related to element design peculiarities, cost trade studies, and cost estimating.

Project Officers will develop AFSC Form 40s which will require the contractor to report major design trades and supporting rationale prior to major design reviews. They will define the reporting necessary to provide traceability of engineering or management decisions and DTUPC target evolution as the design and its production implementation evolve.

PREREQUISITES: Subsystems defined. Program plans and procurement schedules available. Task 4.2.9.2 conducted concurrently.

OUTPUT: Completed DD Form 1423s and corresponding CDRL item references in SOW.

USE OF TASK OUTPUT: Provides LCC/DTC data requirements statements for incorporation in RFPs. CDRL items will require delivery of necessary contractor data.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

	MX Program Management Plan
DoDD 5000.1	Acquisition of Major Defense Systems
DoDD 5000.2	Major System Acquisition Process
DoDD 5000.28	Design to Cost
AFR 310-1	Management of Contractor Data
AFR 800-11	LCC/DTC Implementation
MNOI 310-1	Procedures for Implementation of AFSCR 310-1

4.2.9.4 Develop Instruction for Proposal Preparation

OPR: SAMSO/MNC with support from POs and MNNX

TASK DEFINITION: Prepare instructions for contractor proposal preparation and incorporate them into the RFPs. The instructions will require each bidder to submit an LCC/DTC plan and a recommended DTUPC goal with justification and derivation data. Define the costing ground rules to be based in proposing DTUPC goals. Define the role of LCC/DTC in source selection.

PREREQUISITES: Tasks 4.2.1, 4.2.2, 4.2.9.1, 4.2.9.2, and 4.2.9.3 completed.

OUTPUT: Definitive instructions for proposal preparation in areas related to LCC/DTC

USE OF TASK OUTPUT: Provides specific definition of proposal structure and content.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 5000.1	Acquisition of Major Defense Systems
DoDD 5000.2	Major System Acquisition Process
DoDD 4105.62	Selection of Contractual Sources for Major Defense Systems
DID UF-7-SAMSC	Design to Cost/Life Cycle Cost Document

4.2.9.5 Provide LCC/DTC Ground Rules and Employment Concepts

OPR: SAMSO/MNPC and MNNX-S

TASK DEFINITION: Provide the MX LCC/DTC ground rules and weapon system employment concepts to contractors as part of the RFP. Identify to contractors the status of the documentation and its precedence with respect to other program documentation. Project Officers will clarify and expand upon the documented information during contract performance, consulting with MNPC and MNNX-S as necessary.

PREREQUISITES: Tasks 4.2.1, 4.2.2, and 4.2.3 completed.

OUTPUT: Contractor awareness of ground rules and employment concepts

USE OF TASK OUTPUT: Provides guidance to contractors for proposal preparation.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

None

4.2.9.6 Develop Incentive Approach

OPR: SAMSO/MNC with support from POs, MNNX, and MNB

TASK DEFINITION: Structure contractual incentives to motivate contractors toward the reduction of MX LCC. Incentives consist of perceived total rewards for cost avoidance and cost control, where cost includes acquisition, operation, and support costs. Consider recommendations from POs and MNNX.

Maintain the maximum possible level of competition into and during the production of the weapon system. Establish procedures and ground rules for adjusting incentive structures in response to program or contractual changes.

Structure specific incentive provisions to prevent "gaming" by contractors to the disadvantage of the Government.

PREREQUISITES: PP developed. Tasks 4.2.1, 4.2.6.1 completed.

OUTPUT: Incentive structures documented in RFPs.

USE OF TASK OUTPUT: Provide motivation for contractors to actively pursue achievement of DTUPC targets while minimizing LCC.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 5000.1	Acquisition of Major Defense Systems
DoDD 5000.2	Major System Acquisition Process
AFR 800-11	LCC/DTC Implementation
AFLC/AFSCP 800-19	Joint Logistics Commanders' Guide on Design to Cost
	Joint AFSC/AFLC Commanders' Working Group for LCC, Supplemental LCC Program Management Guidance, January 1976.

4.2.9.7 Review Procurement Packages for LCC/DTC Program Compatibility

OPR: MNNX

TASK DEFINITION: Review procurement packages to ensure compatibility with the intent and implementation of the MX LCC/DTC program. Identify unnecessarily restrictive procurement approaches that would limit contractor flexibility in making design and cost trade-offs. Recommend revisions to procurement packages where appropriate.

PREREQUISITES: Procurement package drafted.

OUTPUT: Recommendations for changes to procurement packages

USE OF TASK OUTPUT: Provides inputs to POs, MNC, and MN for consideration of procurement package changes.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

MX LCC/DTC Plan

4.2.9.8 Provide Source Selection Evaluation Guide Criteria for LCC/DTC

OPR: Source Selection Authority (SSA) with support from Proposed Evaluation Assessment Group (PEAG), Project Officers, and MNNX

TASK DEFINITION: MNNX and the Project Officers will provide the PEAG with tailored inputs on LCC/DTC-related source selection criteria. These will include suggested priorities and weights on evaluation items and factors for the technical, management, and cost proposals. The PEAG will incorporate the inputs as appropriate into the source selection evaluation guide.

PREREQUISITES: A tailored procurement strategy. Establishment and dissemination of LCC/DTC ground rules. LCC/DTC inputs to RFPs.

OUTPUT: LCC/DTC related source selection evaluation guide criteria

USE OF TASK OUTPUT: Aids in evaluating proposals and identifying which proposal offers the greatest likelihood of providing a system meeting performance requirements at minimum life cycle cost.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 4105.62	Selection of Contractual Sources for Major Defense Systems

4.2.9.9 Evaluate Contractor Proposals and DTUPC Goals

OPR: SSA with support from PEAG

TASK DEFINITION: Review and evaluate proposals according to the criteria developed in Task 4.2.9.8. Evaluatee DTUPC goals based on contractor-provided information and Program Office estimates.

PREREQUISITES: Proposed evalution guidelines. Program Office DTUPC estimates. Incentive structure definition.

OUTPUT: Documentation of proposed evaluation; selected contractor(s)

USE OF TASK OUTPUT: Provide traceable documentation of the contractor evaluation process. Select a contractor who provides the best potential for balance among performance, schedule, risk, and life cycle cost.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

DoDD 4105.62	Selection of Contractual Sources for Major Defense Systems

4.2.10 Manager Contractor LCC/DTC Activities

OPR: SAMSO/Project Officers

TASK DEFINITION: Identify (with contractor support) those elements and employment concepts expected to drive life cycle cost. Concentrate management efforts on LCC drivers and treat the remainder by exception. Use TI meetings, MDR, SDR, PDR, and CDR to review contractors' progress in implementing their LCC/DTC programs. Review and evaluate the LCC/DTC impacts of 1) latest design changes, 2) producibility problems or innovations, 3) possible materials or parts shortages, 4) application of new technology to reduce LCC rather than increase performance, and 5) specific techniques for LCC prediction.

Monitor contractor progress at the highest WBS level sufficient to provide visibility into the trends of production cost. This can usually be accomplished at the 3rd and 4th WBS levels. Review and analyze contractor reports that include the latest cost estimates, problem areas, proposed solutions, and any revisions made in his suballocated cost goals. Prepare management summaries of contractor progress for Program Office review.

Conduct DTUPC variance analyses. Present a thorough identification and definition of potential problem areas and identify opportunities for significant cost tradeoffs, especially those outside the control of the subsystem contractor.

Ensure that each contractor develops and maintains a cost model for incorporation into the MAP weapon system LCC/DTC model and for conducting element trade studies. With the assistance of MNBR, track and update analytical models of reliability. Work with MNNX-S, ATC/XPQ, and MNL to minimize personnel and training requirements for the operation and maintenance of subsystems.

Approve contractor decisions regarding design and cost trades within their respective elements and contractual targets. Allow contractors to reallocate lower WBS level goals provided there is no impact on total element targets. Support MNNX in the assessment of trades involving or impacting more than one element.

PREREQUISITES: Contract award.

OUTPUT: Updated data on cost to date, estimates at contract completion, LCC estimates, and life cycle cost drivers; management reports on progress toward meeting cost targets, cost-related problem areas, and detrimental trends; ECPs identified as providing significant opportunity for LCC reduction.

USE OF TASK OUTPUT: Provides cost visibility to POs for early identification of LCC drivers and problem areas. Identifies opportunities to invest development or acquisition dollars for significant LCC savings. Provides strict control of cost growth through control of changes.

GUIDANCE OR DIRECTIVE DOCUMENTATION:

AFLC/AFSCP 800-19	Joint Logistics Commanders' Guide on Design to Cost

5
RESOURCE AND TASK SCHEDULES

5.1 PERSONNEL

The task descriptions of Section 4 imply significant personnel resources for implementation. The primary mode of implementation, however, will be to integrate LCC/DTC-oriented actions into all other program functions, rather than to establish a large and isolated support staff. Wide dissemination and acceptance of LCC/DTC objectives among program personnel are necessary conditions for successful deployment of affordable systems. The primary focal point for LCC/DTC tasks will be the LCC/DTC Manager in MNNX. Implementation at the element level will be the responsibility of the respective POs.

5.2 FUNDING REQUIREMENTS

The cost of implementing the LCC/DTC program will be included in the POs' requests for funds.

5.3 TASK SCHEDULES

Figure 5-1 depicts the top-level LCC/DTC task schedules.

5.4 COMPUTER RESOURCES

Due to the significance of cost estimating, modeling activities, and data base management for the LCC/DTC tasks, computer resources are required to support the LCC/DTC program. Specific applications of computer resources will include 1) the SPARC model, 2) the MAP weapon system LCC/DTC model, 3) effectiveness and operations assessments of the weapon system with appropriate models, 4) logistic support analysis (LSA), and 5) the processing of LSA record (LSAR) data banks for cost inputs.

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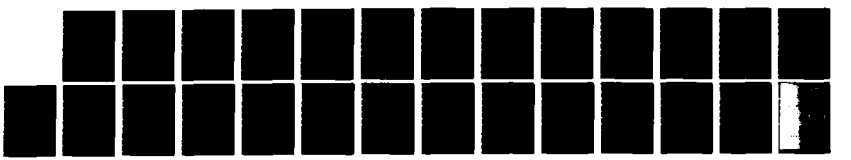

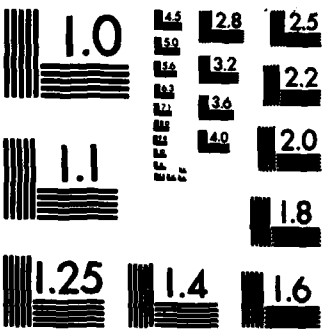

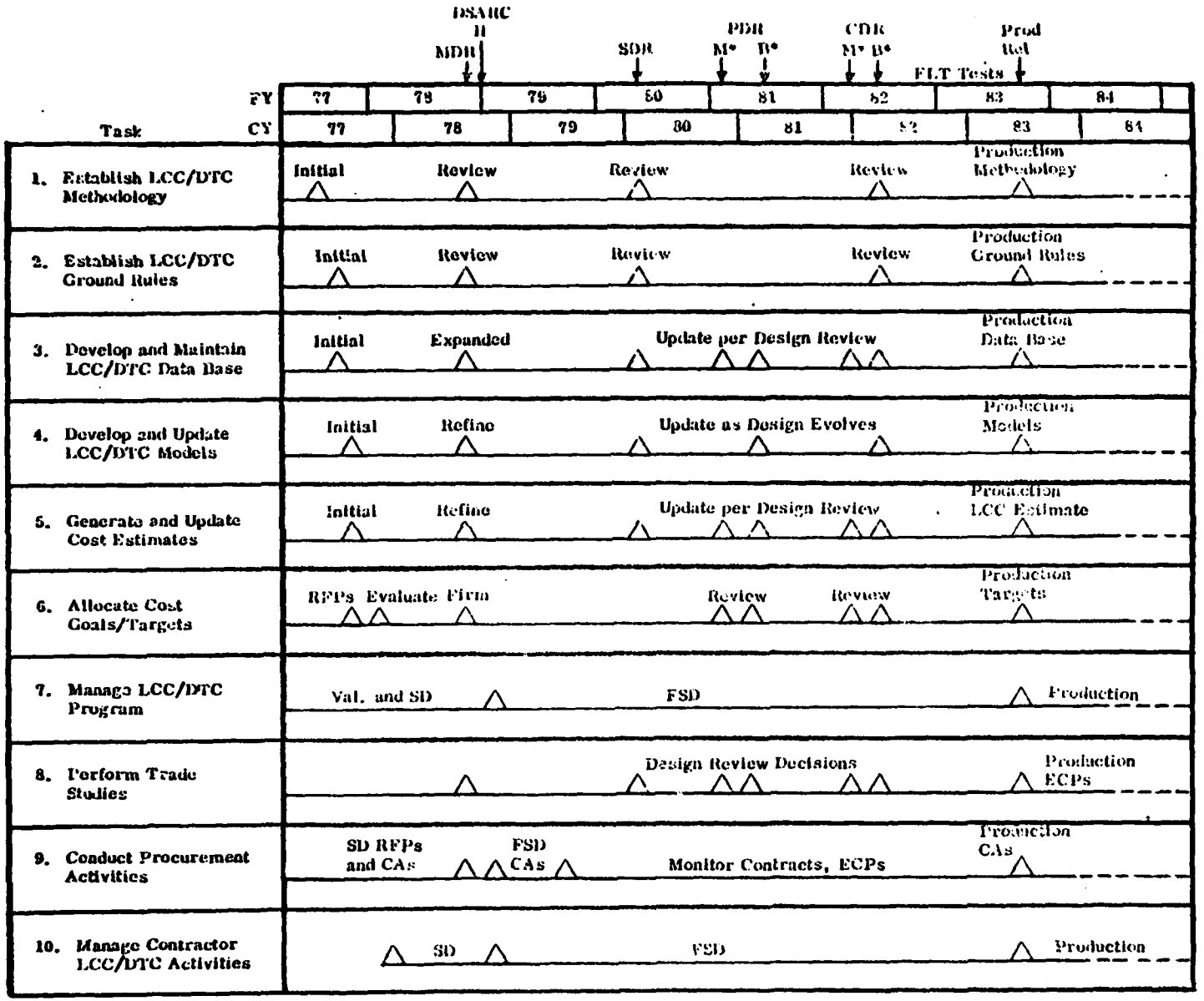

*M = missile, B = basing

Figure 5-1. LCC/DTC Task Schedule

6
GLOSSARY OF TERMS

This section contains definitions and explanations of selected terms used in this document. The definitions are tailored to clarify the meaning of the terminology as it is used in the context of the MX LCC/DTC Plan and as it applies to the MX program.

Air Vehicle (missile) - The sum of those hardware, software, and service items included in Program Breakdown Code items 011100, 021100, 022100, 023100, 024100, 032100, 041100, 042100, and 051100. (Ref. "Dictionary of Standard Program Breakdown Codes and Work Breakdown Structure, MX Multiple Aimpoint Weapon System", USAF SAMSO, dated November 1976)

Approval - Approval of selected LCC/DTC task and subtask outputs is the responsibility of the MX Program Manager. Outputs will be submitted to the Program Manager for his review. Upon determination that the outputs are satisfactory and consistent with Program Office plans, policies, and objectives, he will indicate his approval of the output for dissemination and use. Outputs denied approval will be returned to the OPR for modification. In general, the Program Manager must approve the output from tasks that 1) require system level decisions, 2) could affect the total MX program in a significant manner, and 3) provide information for use outside the ICBM Program Office or require coordination with activities outside the Program Office.

Cost Drivers - Factors such as technical performance requirements, program schedules, and O&S concepts which, when varied, cause significant changes in the cost of developing, buying, and/or owning the MX weapons system.

Cost Sensitivity Analysis - Analysis performed to determine the change or rate of change of cost in response to a given change in some other system or program parameter. The purpose is to identify relatively sensitive parameters (i.e., those for which relatively large changes in point estimates of cost are caused by relatively small changes in parameter values) and to devote additional resources to analysis and control of these. Sensitivity analyses may consist of arbitrarily varying input values, or a more formal approach using probabilistic specification of input values based on historical data and/or "expert" judgment.

Design to Cost (DTC) - In accordance with DoD Directive 5000.28, DTC is a "management concept wherein rigorous cost goals are established during development and the control of system costs (acquisition, operating, and support) to these goals is achieved by practical tradeoffs between operational capability, performance, cost, and schedule. Cost, as a key design parameter, is addressed on a continuing basis and as an inherent part of the development and production process."

The emphasis of DTC in DoDD 5000.28 is on Design to Unit Production Cost (DTUPC) rather than Design to Life Cycle Cost (DTLCC) due to the generally inadequate visibility into and predictability of O&S costs of systems being developed. However, the ultimate objective of DoD is DTLCC, and an effort within DoD to greatly improve visibility and management of O&S cost (VAMOSC) is underway. In this vein of transition from DTUPC to DTLCC, 5000.28 states that: "Although this initial goal uses production costs, the management objective during design and development shall continue to include the control the future operating and support costs. The major operating and support cost factors shall have goals established in the form of measurable numbers (e.g., numbers of O&S personnel, reliability and maintainability factors, etc.) which can be monitored during test and evaluation as well as in operation. These factors shall have emphasis equal to other cost factors in acquisition cost management."

DoDD 5000.28 defines a DTC gcal as "...a specific cost number, in constant dollars, based upon a specified production quantity and rate, established early during system development as a management objective and design parameter for subsequent phases of the acquisition cycle." The elements to be included in DTUPC goals for MX will be defined in the LCC/DTC ground rules document.

Design to Unit Production Cost (DTUPC) - A management concept establishing a per-item production cost ceiling as a goal/target, within which the item must be designed to perform to specified levels. The general definition of unit production cost for MX elements (see definition below) will be a modified version of the "flyaway cost" definition in DoD Manual 7110.1M. It will include all production contract costs, both non-recurring and recurring, for a specified production quantity, rate, and delivery schedule. The DTUPC goal will be expressed in FY76 constant dollars and will represent the cost of the first unit as determined from total production contract cost, quantity procured, and a standard cost

improvement curve. The specific, quantitative details of the DTUPC goals/targets and a detailed definition of the cost elements to be included will be provided in the MX LCC/DTC ground rules. Three levels of goals/targets will be defined:

a. The air vehicle goal established between higher headquarters and the MX Program Manager

b. DTUPC goals between the Program Manager and the POs

c. DTUPC targets between the POs and the contractors

Element - The definition depends on the particular context in this document, but generally is a generic term for a subsystem, unit, component, configuration item, etc. The Third Generation Gyro (5th level PBS item) and the Transporter Launcher (2nd level PBS item) are both LCC/DTC elements. Generally, LCC/DTC elements follow the Program Office structure for POs. However, an element could be a subset of a PO's responsibilities if the element is identified as a high cost driver requiring individual cost visibility and management attention.

Goal - A quantitative management objective established either between higher headquarters and the Program Manager or between the Program Manager and a PO. The goal may be either a Design to Unit Production Cost goal or an O&S factor goal. The detailed explanation of what is included is to be defined in the LCC/DTC ground rules developed under Task 4.2.2. (See also the definition of "target" below.)

K-Factor - A multiplicative factor applied to a parameter to adjust its predicted value to account for an anticipated change in some external, influencing condition. K-factors are commonly applied to reliability characteristics measured in the laboratory to indicate the anticipated increase in failure rates when a system is deployed in a field environment.

Life Cycle Cost (LCC) - The total cost to the Government of acquisition and ownership of the weapon system over its useful life or other specified period of time. It includes the cost of development, production, deployment, operation, support, and where applicable, disposal. For MX, the detailed specification of LCC elements and appropriate time frame for life cycle costing will be given by the LCC/DTC ground rules document.

Life cycle costs will be estimated in order to consider ownership costs (e.g., operation, maintenance, and support costs) as well as development and acquisition costs. This will enable assessment of the economic implications of design alternatives and program options from a total cost viewpoint.

Life Cycle Cost Working Group (LCCWG) - An advisory and working group composed of representatives from the ICBM Program Office, SAC, AFLC, ATC, and AFTEC. The basic authority and responsibility for LCCWG activities is retained by the Program Office. The LCCWG is chaired by the designated LCC/DTC Manager in the Program Office. The function of the MX LCCWG is to 1) support MX LCC/DTC modeling and estimating disciplines; 2) develop, review, and validate MX LCC/DTC models; 3) develop and maintain configuration control on all LCC/DTC models; 4) develop and provide methodology for managers to evaluate and validate DTC considerations; 5) determine areas for tradeoff studies; and 6) assist in developing contractor incentives for success in applying DTC techniques. MNOI 800-2 delineates specific responsibilities and procedures for the LCCWG.

Management Reserve - That portion of a Program Manager's assigned goals which he sets aside prior to allocating the remainder of the goals to individual POs and contractors. The Program Manager will use his management reserve as his assigned efforts progress, to provide the management flexibility necessary to accommodate deviations from anticipated results or progress within his assigned goals.

MAP Weapon System LCC/DTC Model - A model implemented on a Program Office computer that calculates the sum of RDT&E, Acquisition, and O&S costs for the MX Buried Trench and Shelter Based Weapon System configurations. The emphasis in the model's capabilities is placed on estimating cost differences as a function of system design and program plan changes, rather than on accurate calculation of absolute life cycle cost.

Operations and Support (O&S) Cost - Generally, the differential operating and support costs incurred as a result of introducing the MX weapon system into the force structure. Contrary to the usual Cost Analysis Improvement Group guidelines, these shall include such system-related costs as overhead, base facility real-property maintenance, and road construction and repair. The O&S cost elements will include squadron operations, base operating support, logistic support, personnel support, and

recurring investment. The detailed cost terms to be included and the cost element structure for O&S costs will be defined in the LCC/DTC ground rules (Task 4.2.2). They will be related to a particular time frame, quantity, and delivery rate also to be defined by the ground rules.

Operations and Support Factors - Those factors that determine the resources required to operate and support the weapon system during the operational phase of its life. Goals and targets will be established for O&S factors having the greatest impact on O&S costs, in lieu of goals for direct ownership costs. These O&S factors typically include such specified numbers as reliability (MTBF), maintainability (MTTR), personnel requirements (quantities and skill mixes of maintenance and operations personnel), personnel training, support equipment acquisition costs, and average cost of repairs. Contractual targets for O&S factors will be established by incorporation into configuration item specifications. They will be in the form of measurable numbers that can be monitored during test and evaluation and verified in early phases of deployment and operation.

Performance - The multiple quantitative attributes of weapon system technical capabilities, e.g., range, accuracy, response time and availability, throw weight, hardness, and survivability. Performance is closely allied to system effectiveness, defined as the probability of successfully accomplishing a designated mission.

PO - The term PO as used in this document designates a Project Officer and/or Project Element Officer, dependent upon the specific context. This is an operational identity designating the interface between the Program Office and the contractor, or by context, between the Program Manager and Engineering (MNN) for a particular element.

Primary Responsibility - The responsibility to perform an identified specific task or subtask and coordinate the activities of any supporting organizations. The designated office of primary responsibility (OPR) is also responsible for making and disseminating any decisions that are internal to the conduct of the task; for reporting the results of the task to all interested parties; and for submitting outputs to the Program Manager for approval, when required. Performance of all or part of assigned tasks or subtasks may be delegated outside the OPR, if such delegation can be accomplished without interference to the task interrelationships, flow, or schedule. The

OPR, however, will remain responsible and accountable for the proper and successful completion of the task.

Program Manager - The MX Program Manager is the Deputy for Intercontinental Ballistic Missiles and is responsible for the development, acquisition, and deployment of the MX weapon system.

Review and Comment - Selected organizations have been identified (Figure 4-2) to review task or subtask outputs and comment to the OPR. This function is intended to provide advisory assistance to the OPR by drawing upon specialized expertise in various areas. Organizations so tasked will review outputs provided by the OPR, evaluating their adequacy and correctness in light of specific disciplines or areas of interest. Reviewing organizations will prepare written responses, unless the OPR indicates that a verbal response is acceptable. Responses will summarize the adequacy of the output, identify deficiencies or problem areas, and recommend solutions or output modifications. Recommendations will be action-oriented and as specific as possible. Recommendations will not be binding upon the OPR.

Risk (and Uncertainty) - Although risk and uncertainty have formal definitions and are usually distinguished from one another, they are used interchangeably in this document. For most cases, risk is operationally defined as a subjective prior assessment of the relative likelihood of specified outcomes, given a particular set of conditions and prior information. Risk and uncertainty have several components. These are:

a. Technical uncertainty - Uncertainty as to the achievement and measurement of technical performance

b. Cost uncertainty - Uncertainty as to development, production, or O&S cost outcomes for a given technical configuration

c. Requirements uncertainty - Program uncertainty as to the technical configuration of the equipment that must eventually be fielded.

In addition, schedule uncertainty is interactive with all of these. (A more detailed treatment of risk/uncertainty in the LCC/DTC context is contained in the Joint AFSC/AFLC Commanders' Working Group LCC Procurement Guide, July 1976, pp. 3-9 to 3-12.)

SPARC Model - Scheduled Program Allocation of Resources and Costs model, implemented on a Program Office computer. The model calculates time-phased cost estimates of advanced weapon systems in a variety of formats. The basic structure of the model is designed to agree with the appropriation and work breakdown structure described in MIL-STD-881 and AFM 300-4 (July 1, 1970). This model will be used to generate the Program Office MX weapon system LCC estimates to be released to AFSC, Hq USAF, and DoD and for budgetary allocations. (Ref. Aerospace Corporation Report TOR-0066(5529)-4, "SPARC Total System Time-Phased Cost Model II User's Manual", dated 5 March 1971)

Support - An organization having support responsibility will participate actively in task or subtask performance, either in an advisory capacity or in carrying our subtasks delegated by the OPR. The support organizations will be directed by the OPR in determining what support is required and at what points in time. The nature of their participation will vary widely, depending on the particular tasks involved. Typical participations will include preparation of data bases in specialized areas, submodel developments, preparation of detailed plans or requirement definitions for selected efforts, and specifically directed analyses or trade studies.

Target - A contractual, quantitative objective established between the Program Office and the contractor. Target allocation is normally controlled by the PO within his goal for the individual area of responsibility. The contractual target is normally a subset of the PO's goal and may include either a Design to Unit Production Cost target or an O&S factor target, or both. As with goals, the details of what is to be included will be defined in the LCC/DTC ground rules. (See definition of "goal" above.)

Trade Study - LCC/DTC trade studies are a part of the overall design and development effort wherein studies are conducted by the contractors or the Program Office to assess the LCC and performance impacts of alternative design implementations, employment concepts, and support alternatives. The outputs from trade studies will provide management with data on which to base design and program decisions. An example of an LCC/DTC trade study might be the analysis of impacts on development and acquisition cost, O&S cost, and performance due to the physical layout of a particular subsystem, considering thermal effects on reliability and the maintainability aspects of ease of access for repairs.

Weapon System - The weapon system includes all hardware, software, and personnel necessary for the operation of the MX. It includes both the missile and the necessary basing equipments and facilities.

Appendix B

Data Item Descriptions

DATA ITEM DESCRIPTION

2. IDENTIFICATION NO(S).	
AGENCY	NUMBER
USAF	DI-F-30203

1. TITLE

Design to Cost/Life Cycle Cost Document

3. DESCRIPTION/PURPOSE

This document is to provide the procuring activity with the contractor's recommended Design to Cost/Life Cycle Cost (DTC/LCC) report. This report consists of a DTC/LCC plan, engineering trade studies, and cost data report.

4. APPROVAL DATE

26 Jan 77

5. OFFICE OF PRIMARY RESPONSIBILITY

AFSC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

This document is applicable to the acquisition of systems, subsystems, and components in all program phases, including concept, validation, full scale development, and production.

If applicable, this document should be prepared in conjunction with DI-S-3569, "System/Cost Effectiveness Program Plan"; or DI-S-3606, "System Design Trade Study Report" in order to ensure coherence among cost and engineering documentation.

Replaces UF-7-SAMSO

9. REFERENCES (*Mandatory as cited in block 10*)

DODD 5000.1
DODD 5000.2
DODD 5000.26
DODD 5000.28
AFR 800-11/SAMSO SUPP
AFLC/AFSCP 800-19
MIL STD 881

MCSL NUMBER(S)

10. PREPARATION INSTRUCTIONS

The Design to Cost/Life Cycle Cost Report shall be used to present preliminary and updated cost data. The report shall be divided into three parts.

PART I - Design to Cost/Life Cycle Cost Plan
PART II - Cost Data
PART III - Engineering Trade Studies Report

PART I - Design to Cost/Life Cycle Cost Plan. This part of the report shall present the contractor's plan for establishing and managing the projected Life Cycle Cost and Design to Cost Goal of the system baseline and baseline excursions. The plan shall specifically include the following:

a. A recommended Life Cycle Cost and/or Design to Cost Goal based on minimum life cycle costs.

b. Description of the DTC/LCC model which the contractor shall develop (unless furnished by the government) using the contractor WBS prepared in accordance with MIL STD 881.

c. Description of the relationships among engineering, manufacturing, and cost analysis activities.

d. Preliminary list of the ten (10) most influential contractual requirements, e.g., performance, schedule, standards, specifications, and etc. that affect the DTC goal and the LCC of the system.

PART II - Cost Data. This part of the report shall summarize the preliminary and updated DTC goal and LCC estimate of the system. The contractor shall present data using the following outline as a guide:

COST DATA

System and Program Description--Summary
System Description
Program Description
Program Schedules--Summary
Costing Ground Rules and Assumptions
Life Cycle Costs
Rank Ordered List of Systems Components Which Account for Not Less Than 80% of the Total Estimated System LCC
RDT&E Costs
Production Costs--DTC Goal
Operations and Support Costs
Time-Phased Program Costs
Funding Spreads
Rate Sensitivities
Cost Risk Analysis
Cost Risk Methodology
Cost Risk
Supplemental Data

PART III - Engineering Trade Studies Report. This part of the report shall summarize the contractor's methodology and decision rationale in conducting, as well as the results of, design trade-off studies and analyses which evaluate the impacts on any life cycle cost element. This section shall include the following:

a. Introduction - Each study should be clearly identified. The reason and/or rationale for each study should be outlined. A brief description of what results are expected and how these results may impact on the other program elements should also be included. Relation to other trade studies should be discussed.

b. Summary - The results of the analyses should be summarized in narrative form with a minimum of quantitative data. All recommendations should be stated concisely.

c. Description of Analysis Methods and Special Techniques - Provide a narrative explanation of the methodology used to reach conclusions. Comment on the adequacy of the

techniques used in the particular trade study. Specific areas where techniques did not reflect the "real" world should be covered. Also, areas that were omitted should be mentioned. Any assumptions should be identifed.

d. Results - The actual results of the analyses should be discussed and compared against the expected goals outlined in the introduction. Cost of alternatives and reasons for selection should be summarized. Any differences between the actual result and what was expected should be exposed so that managers not ordinarily familiar with quantitative analysis methods will understand the explanations.

e. Data Element Sources - Data sources should be clearly identified. Indicate the degree of confidence in the accuracy of the data. Where possible, identify those data elements which drive the results and any action undertaken to improve confidence in the accuracy of these senstive data elements.

f. Recommended Areas of Future Cost Trades - Identify the specific subsystems/equipments in which cost trade study emphasis should be placed in the near future, and summarize the progress made in each of these areas as a result of cost trades to data.

DATA ITEM DESCRIPTION

2. IDENTIFICATION NO(S)	
AGENCY	NUMBER
USAF	DI-F-30203/M

1. TITLE

DESIGN-TO-COST/LIFE CYCLE COST DOCUMENT

3. DESCRIPTION/PURPOSE

This document is to provide the procuring activitiy with the contractor's recommended Design-to-Cost/Life Cycle Cost (DTC/LCC) report. This report consists of a DTC/LCC plan, engineering trade studies report, and cost data report.

4. APPROVAL DATE

26 Jan 77

5. OFFICE OF PRIMARY RESPONSIBILITY

AFSC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

This document is applicable to the acquisition of systems, subsystems, and components of all program phases, including concept, validation, full scale development, and production.

If applicable, this document should be prepared in conjunction with DI-S-3569, "System/Cost Effectiveness Program Plan"; or DI-S-3618, "System Engineering Management Plan (SEMP)"; or DI-S-3606, "System Design Trade Study Reports" in order to ensure coherence among cost and engineering documentation.

Replaces UF-7-SAMSO

9. REFERENCES (Mandatory as cited in block 10)

DODD 5000.1
DODD 5000.2
DODD 5000.26
DODD 5000.28
AFR 800-11/SAMSO Supp
AFLCP/AFSCP 800-19
MIL-STD 881

MCSL NUMBER(S)

10. PREPARATION INSTRUCTIONS

The Design-to-Cost/Life Cycle Cost Report shall be used to present preliminary and updated cost data. The report shall be divided into three parts:

Part I - Design-to-Cost/Life Cycle Cost Plan
Part II - Cost Data
Part III - Engineering Trade Studies Report

Part I - Design-to-Cost/Life Cycle Cost Plan. This part of the report shall present the Contractor's plan for establishing and maintaining the Life Cycle Cost Program. This plan specifically includes the following:

a. Recommended Life Cycle Cost Goals based on minimum life cycle costs. Such goals may be maintainability or reliability (shop visit rate MTBF) parameters identified as significant Life Cycle Cost Drivers as well as engine production costs. Include a description of planned feedback mechanism for tracking and reporting cost-related design goals and status and proposed analysis, test, and evaluation efforts to be used as progress checks.

b. Description of the DTC/LCC methodology which the contractor shall use, including Use manual(s) for any computerized model, associated costing ground rules and assumptions, detailed description of approach to sensitivity analysis, model inputs, model outputs, and data sources. This will include the impact of sensitivity analysis on the cost-related design goals. Verification/validation of input data will be performed by AF personnel at contractor's facility. A new LCC model is not required.

c. Description of the relationships among engineering, manufacturing and cost analysis activities, and logistics support analysis (LSA).

d. Description of the reliability, maintainability, and cost information used to generate the life cycle cost goals and life cycle costs which are consistent with and traceable to Failure mode Effects and criticality analysis, Logistic Support Analysis, and spares provisioning (where applicable).

e. Management and methodology for integrating subcontractor efforts into LCC management efforts.

f. Work breakdown structure (WBS) to the lowest repairable level.

Part II - Cost Data. This part of the report shall summarize the preliminary and updated DTC goals and LCC estimate of the system. It shall identify and explain variances from previous established goals and LCC estimates of the system. The contractor shall provide data using the following outline as a guide:

COST DATA

Engine System & Program Description--Summary

Engine System Description

Program Description (include description of planned scheduled maintenance actions)

Costing Ground Rules and Assumptions

Life Cycle Costs (costs to be displayed by government FY periods in both government FY81 constant dollars and discounted dollars)

Status of DTC/LCC Goals with listing of top ten drivers/ contributors for these goals

RDT&E Costs

Production Costs - DTC Goal
- Cost of Installed Engines
- Cost of Spare Engines
- Cost of Technical Orders
- Cost of Personnel Training (Type I)
- Cost of Support Equipment

Operations and Support Costs
- Cost of Total Recurring Spare and Repair Parts (Depot and Base--Separately)
- Cost of On-Wing Labor
- Cost of Off-Wing Labor (Depot and Intermediate--Separately)
- Cost of Inventory Management
- Cost of Technical Orders
- Cost of Personnel Training (Type I)
- Cost of Support Equipment
- Cost of Unique Facilities
- Cost of Fuel Consumed/Composite Mission
- Cost of Second Destination Transportation

Variance Analysis - Deviations from previous LCC shall be identified.

Sensitivity Analysis - shall be performed in accordance with Atch 1 hereto.

Part III - Engineering Trade Studies Report.

1. This part of the report shall summarize the contractor's methodology and decision rationale in conducting, as well as the results of, design trade studies and analyses made, which evaluate the impacts on any life cycle cost element. In addition, the Contractor shall identify the specific sub-system/equipments in which cost trade emphasis should be placed in the near future, and summarize the progress made in each of these areas as a result of cost trades to date. LCC trade studies will be performed as a minimum to document:

    a. Selection of the hardware and support system design approach.

    b. LCC sensitivities to performance requirements.

    c. Cost-related design goals.

    d. Design trade-offs which significantly impact LCC results.

    e. Choice of maintenance and support concepts.

2. The contractor shall develop a list of items/equipments (line replaceable units (LRUs) and first indenture shop replaceable units (SRUs)) from his proposed design which are potential LCC drivers. The list shall identify a minimum of 25 items/equipment. Following review of this list, the AF will identify 10 items/equipments. The contractor shall identify optional approaches for these items/equipments. Recommended alternatives shall address potential LCC savings and the impact on performance and mission capability.

3. An LCC impact assessment on all contractor change proposals (CCP) and engineering change proposals (ECP) shall be prepared.

APPENDIX B

POST USE VALIDATION SURVEY

1. What is your current grade and job title?
2. In which ASD organization do you work?
3. Have you received any formal training in LCC Management from AFIT or any other institution?
4. Have you read the entire Primer or just parts of it?
5. Considering your reasons for reading the Primer, did you find the Primer useful?
6. Which portions or chapters of the Primer were most useful; which portions or chapters were least useful?
7. Do you feel that the discussion concerning Cost-Related Design Goals was complete? If not, what information would you add?
8. If you used the Primer for developing LCC Management inputs to an RFP, do you feel that sample inputs in the Primer were helpful or not?
9. Is the Primer too lengthy or difficult to read?
10. In general, what could be done to the Primer to make it more useful or readable?

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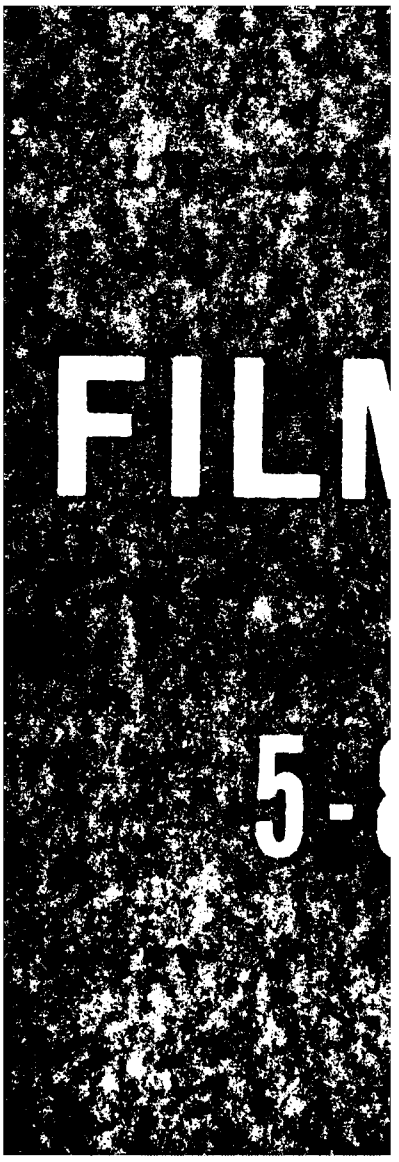
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